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Trade Policy

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Effective Incentives in India's Agriculture

Cotton, Groundnuts, Wheat, and Rice

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with
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A policy that moves prices closer to free trade levels would shift resources from groundnuts (or oilseeds) into cotton, rice, and wheat — crops for which India has more of a comparative advantage and would earn more in foreign exchange. This would also allow agriculture to compete with industry for investment rupees.

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This paper — a product of the Country Operations Division, New Delhi Resident Mission, and the Trade Policy Division, Country Economics Department — is part of a larger effort in PPR to quantify incentives in agriculture and to analyze the effects of the trade policies of developing countries on the allocation of resources between different crops and between agriculture and industry. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Ghislaine Bayard, room N10-021, extension 38004 (138 pages with tables).

Detailed estimates of effective subsidy coefficients for four crops — cotton, wheat, rice, and groundnuts — yielded the following conclusions about agricultural incentives in India (among others):

Wheat, rice, and especially cotton have been disprotected (in effect, taxed) in the 1980s. Groundnuts have been heavily protected, encouraging a different allocation of resources than under free trade.

The incentive framework generates static efficiency losses and net foreign exchange losses, particularly in areas where the crops compete directly for resources. A policy that moved prices closer to free trade levels would shift resources from groundnuts into crops that would earn more in foreign exchange. This increased output, particularly of cotton, could be used to purchase edible oils — with a net gain in foreign exchange.

Investment programs aimed at increasing cotton, rice, and wheat production appear to have high economic rates of return — higher at the margin than investment in industry. Andhra's cotton is a financially and economically profitable export even at current exchange rates. Investment in rice and wheat would yield high economic rates of return as import substitutes, particularly in areas where subsidies are low. Their financial and economic profitability as exports is, however, more doubtful. The evidence on these major crops suggests that in India (as in other developing countries) agriculture as a whole is underpriced, which produces a bias toward the industrial sector.

Subsidies in Indian agriculture are substantial — about 10 percent of value added for groundnuts and cotton, 25 percent for wheat, and 35 percent for rice — and should be considered explicitly in evaluating incentives for agricultural investment and production.

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Executive Summary

1. Government intervention in Indian agriculture is pervasive. It includes support/procurement price policies, explicit and implicit subsidies on inputs that now represent a significant fraction (over 2.5%) of GDP, control over the links between external and domestic markets, research and extension programs, and crop specific programs. Assessments of these wide ranging and sometimes contradictory policies have usually been based on analyses of their impact on the net income per hectare from the crop in question. Sometimes consideration also is given to the opportunity cost of policy-induced substitutions between one crop and another. However, almost all of these analyses rely on domestic prices for their evaluations. This implicitly autarkic approach neglects the possiblities of gains from trade and additional foreign exchange earnings.

2. This study and other recent World Bank analyses of agriculture (Krueger, Schiff, and Valdes) take a different tack -- explicitly considering the possiblities of international trade in evaluating the impact of incentives. Under this approach, incentives for different crops are measured by the ratios between domestic and international prices (appropriately adjusted for input costs, subsidies and the scarcity value of foreign exchange). Commodities with ratios in excess of one are protected by the policy regime, commodities with ratios below one are disprotected (in effect taxed) by the policy regime, relative to the situation that would prevail under free trade.

3. Specifically, this study estimates three standard coefficients (ratios):

a) the nominal protection coefficient (NPC) -- the ratio of domestic to international border prices (the reference prices)
b) the effective protection coefficient (EPC) -- the ratio of value added measured at domestic prices (the domestic price less the per unit domestic cost of tradeable inputs) to value added at international border prices (the international price less the per unit cost of tradeable inputs at international prices)
c) the Effective Subsidy Coefficient (ESC) -- the effective protection coefficient adjusted for the subsidies and taxes on non-tradeables

The EPC measures the protection and subsidies accorded to the land, labor, and capital and non-tradeable inputs used in the production of a commodity, while the NPC measures the protection accorded to the commodity, including all the inputs that go into its production. The importance of this distinction can be seen by noting that a high NPC provides little incentive to use resources in the production of a commodity, if the NPC of the inputs is also high. Hence, the EPC is a better measure than the NPC of the incentive for resources to be used to produce a commodity. Similarly, if non-traded inputs such as credit and electricity are subsidized, then there is greater incentive to apply inputs of land, labor and capital than without subsidy. Consequently, the ESC is a better measure of incentives than the EPC.

4. The study also includes estimates of the nominal protection coefficient adjusted for a premium on foreign exchange (ANPC) and some discussion of how such a premium would affect the EPCs and ESCs. Inclusion of a notional premium on foreign exchange is used to reflect the necessity of a compensatory change in the exchange rate were the economy to move to a free trade environment, as well as the possiblity that the current account deficit is not sustainable in a given year and hence the currency is overvaled even given the trade and exchange control regime (See for example Krueger, Skiff, and Valdes). With the inclusion of such a premium, the estimated coefficients become good proxies for cost benefit indicators such as Domestic Resource Cost (DRC) (See Pursell and Roger and Scandizzo and Bruce). As this estimate is only indicative, the adjustment is formally made only on the NPC.

5. This study covers four commodities: wheat and rice, India's most important cereals; cotton, an important cash crop used in the country's large textile industry; and groundnut as a representative of the oilseeds crop complex. Together, these four crops account for roughly 45 per cent of gross cropped area and above 50 per cent of gross value of crop output. Wheat, rice and cotton experienced technological breakthroughs during late 1960s and 1970s in certain regions, while groundnut yields have lagged behind. Presently, efforts are being made to stimulate oilseed production under the Technology Mission on Oilseeds launched by Government of India in 1986 and a buffer stock/price support scheme was introduced in 1989.

6. Table 1 summarizes the estimates for the protecion coefficients for the four commodities for the 1980s, in addition it contains estimates of comparable domestic and world prices. These coefficients are weighted averages of coefficients calculated for the principal producing states; the state coefficients differing in prices, transport costs to market (which affects the "border" reference price) and degree of subsidies. The coefficients have been calculated under two assumptions: that the crops compete with imports and that they are exported to a particular market. The difference is basically that the international border or reference price is computed by adding on international shipping costs to the price at the foreign market under the importable hypothesis and by deducting international shipment costs from the price at the point of foreign sale in the case under the exportable hypothesis. These two different treatments of transport costs allow the analyst to see whether the Indian production is competitive with imports given the protection accorded by transport costs and what subsidy, if any, would be required to export the crop.

7. The major results can be summarized as follows:

a) Cotton, and to a lesser extent wheat and rice have been disprotected or in effect taxed during the 1980s, relative to the prices that would have prevailed with free imports (the importable hypothesis). This is shown by protection coefficients that generally are less than one.

b) Groundnuts have received substantial protection -- their protection coefficients exceed one and on average, are 1.8 to 2.6 times those for the other crops. In fact the average EPC, 1.56, is above the average effective protection coefficient for industry of 1.4 (World Bank 1987).

Table 1: Temporal Behaviour of Crop-Specific Effective Incentives and Prices in Indian Agriculture[1]

Hypothesis/Crop/Protection Coefficient	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
WHEAT								
NPCs	0.72	0.73	0.84	0.84	0.76	0.76	0.91	0.80
EPCs	0.67	0.68	0.80	0.80	0.72	0.72	0.89	0.75
ESCs	0.76	0.85	0.99	0.99	0.90	0.90	1.12	0.93
ANPCs	0.57	0.58	0.67	0.67	0.60	0.60	0.73	0.63
Domestic Price/a (Rs/q)	117	130	142	151	152	157	162	
World Price/b (Rs/q)	127	148	152	159	170	173	145.	
Price Ratio	0.92	0.88	0.93	0.95	0.89	0.91	1.12	0.94
RICE								
NPCs	0.45	0.51	0.75	0.70	0.72	0.78	0.80	0.67
EPCs	0.43	0.48	0.73	0.68	0.70	0.78	0.78	0.65
ESCs	0.58	0.65	0.99	0.90	0.96	1.01	1.06	0.88
ANPCs	0.36	0.40	0.60	0.56	0.57	0.63	0.64	0.54
Domestic Price/c (Rs/q)	150	164	174	189	196	203	208	
World Price/d (Rs/q)	353	355	255	291	293	274	274	
Price Ratio	0.42	0.46	0.68	0.65	0.67	0.74	0.76	0.63
COTTON								
NPCs	0.77	0.94	0.82	0.68	0.73	0.86	0.83	0.80
EPCs	0.66	0.82	0.71	0.58	0.62	0.74	0.69	0.69
ESCs	0.71	0.90	0.79	0.64	0.67	0.82	0.75	0.75
ANPCs	0.60	0.72	0.64	0.53	0.57	0.66	0.64	0.62
Domestic Price/e (Rs/q)	895	1118	1118	1176	1206	1250	1264	
World Price/f (Rs/q)	1629	1415	1594	1949	1727	1333	1734	
Price Ratio	0.55	0.79	0.70	0.60	0.70	0.94	0.73	0.72
GROUNDNUT								
NPCs	1.06	1.37	1.66	1.41	1.40	1.53	2.05	1.50
EPCs	1.09	1.44	1.74	1.47	1.47	1.58	2.13	1.56
ESCs	1.20	1.55	1.93	1.58	1.60	1.76	2.32	1.71
ANPCs	0.84	1.08	1.31	1.11	1.11	1.21	1.63	1.18
Domestic Price/g (Rs/q)	294	386	421	450	486	500	528	
World Price/h (Rs/q)	382	539	389	396	497	445	409	
Price Ratio	0.77	0.72	1.08	1.14	0.98	1.12	1.29	1.01

(contd.)

Table 1.2: Temporal Behaviour of Crop-Specific Effective Incentives and Prices in Indian Agriculture[1]

Hypothesis/Crop/Protection Coefficient	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Exportable Hypothesis								
WHEAT								
NPCs	1.15	1.09	1.24	1.29	1.27	1.33	1.99	1.34
EPCs	1.29	1.16	1.35	1.47	1.55	1.71	3.44	1.71
ESCs	1.57	1.35	1.57	1.73	1.81	2.00	4.07	2.01
ANPCs	0.87	0.83	0.93	0.96	0.93	0.97	1.38	0.98
RICE								
NPCs	0.50	0.60	0.94	0.89	0.94	1.09	1.16	0.87
EPCs	0.47	0.57	0.93	0.88	0.95	1.13	1.19	0.87
ESCs	0.65	0.77	1.26	1.21	1.30	1.60	1.68	1.21
ANPCs	0.39	0.46	0.70	0.68	0.72	0.83	0.87	0.66
COTTON								
NPCs	0.89	1.13	0.92	0.74	0.83	1.01	0.93	0.92
EPCs	0.78	1.04	0.80	0.62	0.71	0.89	0.79	0.80
ESCs	0.84	1.13	0.88	0.69	0.78	0.99	0.86	0.88
ANPCs	0.70	0.87	0.72	0.58	0.64	0.76	0.72	0.71
GROUNDNUT								
NPCs	1.25	1.72	2.03	1.69	1.76	2.03	2.87	1.91
EPCs	1.44	2.09	2.44	1.90	2.07	2.36	3.45	2.26
ESCs	1.57	2.24	2.69	2.04	2.31	2.63	3.76	2.47
ANPCs	0.99	1.34	1.57	1.32	1.37	1.56	2.20	1.48

Notes: /a Domestic price of wheat is approximated by its procurement price for FAQ.
/b World price is of US Hard Red Winter No. 2 with ordinary protein, fob US gulf (at official exchange rate) for April to June quarter.
/c Domestic price of rice is estimated as procurement price of paddy divided by 0.7, which is paddy-rice conversion factor for Indian 'Common' rice.
/d World price of rice is of Thai white (Miled) 5% Broken, fob Bangkok (at official rate) for October to January.
/e Domestic price of cotton is approximated by procurement price of kapas (J-34/414F/H-777 variety) divided by 0.34, which is kapas-lint conversion ratio.
/f World Price of cotton is that of cotton outlook index 'A'. cif Liverpool.
/g Domestic price of groundnut is its procurement price (in terms of Kernels).
/h World price of groundnut is of Kernels of any origin, cif Europe (Rotterdam).

c) EPCs for cotton,wheat and rice are below the corresponding NPCs (under the importable hypothesis). This reflects the disprotection of these crops (NPCs less than one) combined with the protection of the industrial inputs (pesticides, machinery, fertilizer) used in their production. On the other hand groundnuts have a higher EPC than NPC, because the protection of groundnuts exceeds the protection of its inputs.

d) Estimated net subsidies are large, about 10% of value added in the case of groundnuts and cotton, about 25% in the case of wheat and about 35% in the case of rice. Assuming these large subsidies are distributed evenly across all producers would imply that they offset some of the disprotection -- this is shown by the EPSs that are greater than the EPCs and quite close to one (e.g. wheat .93, rice .88, cotton .75 under importable hypothesis). However, if this assumption is not correct then, as discussed below, some producers of these crops are in effect being taxed (as shown by the EPCs) while others are receiving large benefits.

e) Cotton appears to be an efficient export (protection coefficients less than one under the exportable hypothesis.) Rice and, to a much lesser extent wheat, would be efficient exports provided a 25% premium were accorded foreign exchange, as shown by the ANPCS. Groundnut, on the other hand, would need a foreign exchange premium of 40% or more to be an efficient export.

f) The degree of disprotection for cotton, wheat and rice has been reduced over the 1980s. This largely reflects falling world prices, that have not been offset even by the depreciations of the rupee against the dollar, and not any major rise in domestic prices. In fact, domestic prices rose 5-6% p.a. over the period in question, about the same as the wholesale price index in general. Protection on groundnut also has risen over the period, but this results both from falling world prices and domestic policies that have increased domestic prices about 11% p.a. during the period.

g) The calculations of protection coefficients across states (not shown) indicate at least two significant spatial variations: 1) Punjab rice has a much higher NPC, EPC, and ESC than the other states, reflecting higher prices and, to a lesser extent, the irrigation subsidy; 2) Maharashtra cotton (and to a lesser extent Punjab cotton) received much higher protection and Andhra cotton much lower protection than the average for cotton, reflecting differences in procurement price policy during the period and, to a lesser extent, irrigation subsidies.

h) Of the two main crops, rice is somewhat more disprotected (taxed more heavily) than wheat, compared to the prices that would prevail under free trade. Moreover, the average incentive to rice is brought up by the high protection accorded Punjab rice. Hence, rice and wheat producers in the Punjab and Haryana, and wheat producers elsewhere, receive more incentives than rice producers in the rest of the country.

8. These results have a number of implications:

a) The disprotection accorded cotton, rice and wheat and the high protection accorded groundnuts suggests that the incentive framework for agriculture has stimulated the allocation of resources to groundnuts and discouraged resource use in the other three crops, compared to the allocation of resources that would prevail under a free trade regime.

b) The difference in effective incentives also suggests the possibility that the incentive framework has generated static efficiency losses and net foreign exchange losses, particularly in areas like Gujarat and Andhra Pradesh, where the crops compete directly for resources. A price policy that moved relative prices closer to the free trade levels would shift resources from groundnuts into the other crops, with a net increase in value product measured at international prices. This increased output, particularly if it were cotton, could be sold in international markets in order to buy edible oils, with a net gain in foreign exchange. On the other hand, higher prices for edible oils would tend to reduce the acreage and production of internationally competitive crops. Hence, programs stimulating groundnut production through higher prices would have to have accord a high implicit benefit for self-sufficiency in order to be justifiable.

c) Investment programs aimed at increasing cotton, rice, and wheat production appear to have high economic rates of return. All three of these crops have protection coefficients which, adjusted for an exchange rate premium, are below unity and, as mentioned above, such coefficients are good proxies for cost-benefit indicators such as domestic resource costs (DRCs). By comparison, for example, the average effective protection coefficent for industry is about 1.4. Hence, these estimates suggest that at the margin investment in the three crops would yield a higher economic rate of return than investment in industry. Andhra cotton in particular appears to be exportable even at current exchange rates. The results suggest that investment in rice and wheat would yield high economic rates of return up to the point where they become exports -- i.e. they are efficient import substitutes. This is particularly true in areas where the subsidies are currently low; in the Punjab and Haryana, where effective subsidies to rice are high, the economic returns to further investments in rice production would be lower than elsewhere (See e below). An exchange rate premium of about 25% would mean investments in rice for export markets would also yield a satisfactory economic rate of return, provided world prices rise somewhat and provided the expansion takes place in areas where subsidies to rice are low. Also, the absolute size of rice exports might be limited by the narrowness of the international rice market.

d) Investment programs aimed at increasing groundnut production are likely to yield lower rates of return than cotton, rice, and wheat. Protection coefficients exceed those in Indian industry, suggesting that fairly high protection has been needed to make the present level of resouce allocation to groundnut profitable.

e) Subsidies in agriculture are fairly large and need to be considered explicitly in evaluating the incentives accorded to production of the various crops and the feasiblity of investment programs. The subsidy on canal irrigation -- basically the difference between the sum of annualized capital costs and operating costs less actual revenues -- accounts for

about 70% of total subsidies estimated here. (The fertilizer subsidy looms large in the government accounts, but much of it goes to the producers of fertilizers, to ensure that their production is profitable at current prices, rather than substantially lowering the domestic farmgate price of fertilizer below world prices. Hence the fertilizer subsidy is less important to agriculture than one would expect from looking solely at the budget. It also should be noted that the fertilizer subsidy is included in the EPC, as it is a subsidy on traded inputs, as well as in the ESC -- the other subsidies appear only in the ESC.) The small size of the other subsidies suggests that they could be reduced substantially without requiring much of an offsetting increase in procurement prices (See also below para 9 b). On the other hand, the large subsidy on irrigated crops suggests that further expansion in already irrigated areas may not be as efficient as would seem from simply looking at net incomes per hectare, or even prices, and shifting to less water intensive crops would be warranted on efficiency grounds. There also would appear to be room for increasing water charges, which would provide an incentive for this shift to less water intensive crops.

f) The prevalence of protection coefficients below unity (under the importable hypothesis) supports Schultz's thesis that agriculture in developing countries is underpriced and that there is a bias toward the industrial sector, which in India has an average effective proteciton coefficient of about 1.4. The results are also similar to those reported by Krueger, Schiff and Valdes, particularly in cotton where the controls on exports have delinked the domestic from the international market and depressed the price below international levels. At the same time, imported food products (edible oils of which groundnut is a major component) receive substantial direct protection.

9. The study also raises a number of important issues that deserve further study:

a) Why are certain agricultural products competitive and others uncompetitive? On one level, the answer is that it is not products, but marginal production that is competitive or uncompetitive. The delinking of the domestic and international market has allowed domestic and international prices to diverge and tended to encourage (discourage) additional resource use in crops where prices have risen above (fallen below) international levels. If domestic and foreign markets were to be linked, then domestic and foreign prices would become equal, and producers of all crops would be competitive internationally. However, the current resource allocation pattern would change, with resources being drawn out of the currently protected sectors and into the currently disprotected sectors. On another level, one can ask what policiies and investments would lead to a more internationally competitive agricultural sector. As just noted, closer linking of prices to international levels is one way to make the sector more efficient in a static sense. In terms of growth and investment, the protection coefficients, adjusted for an exchange rate premium, are good proxies for cost benefit indicators, such as domestic resource costs. Hence they are indicators fo relative investment productivities (measured at international prices). It also should be noted that argument for high farmgate prices stimulating development of

high yield varieties (a variant of the infant industry argument for protection), is probably invalid in the Indian context, given the limited impact of market signals on India's research bureauacrac. Finally, more investigation is warranted on the role of transport, marketing and processing costs in limiting India's agricultural export potential -- for example, not only are transport, processing an marketing costs high for Indian groundnuts, the procedures contribute to the high moisture content of the kernels, which in turn increases the risk of aflatoxin that limits Indian groundnuts and groundnut cake exports to the EEC.

b) The impact of subsidies: Estimated subsidies are equivalent to a large percentage of agricultural GDP (16-17% see Gulati 1988a) but their influence on agricultural prices may not be as large as generally thought. Subsidies on irrigation, electricity, and credit lower the costs only of those farmers who have access to canal water, power lines and bank loans. If farmers that do not have such access account for a large fraction of the supply, then their costs determine agricultural prices. In this case, the main impact of the subsidies will be on income distribution -- through the high profits they generate for the recipients -- rather than on prices. This suggests that further investigation is necessary to determine the impact of subsidies on prices and incentives and on income distribution.

c) The potential impact of increased Indian trade on world prices and incentives: Large increases in Indian agricultural exports or imports might affect international prices, owing to the narrowness of some agricultural markets. This is not an argument for ignoring the potential exports, even if the international price falls somewhat the foreign exchange income earned from additoional exports would certainly be positive. However, additional analysis is necessary to see what markets, if any, might be subject to this limitation and how this might affect the protection coefficients and what are the appropriate Indian policies.

CHAPTER 1

AN OVERVIEW OF THE INCENTIVE STRUCTURE IN INDIAN AGRICULTURE

A. Objectives and Methodology

1.01 Government intervention in Indian agriculture is pervasive. The Government tinkers with the market mechanism through its price support/ procurement policy on the one hand, and its subsidization of the major agricultural inputs on the other. The Government's price policy played a role in speeding the adoption of high yielding varieties (HYVs) of wheat and rice in the so-called Green Revolution and it has helped to provide greater certainty for farmers in terms of the prices they can expect to receive. Subsidies have encouraged the use of modern inputs. Estimated subsidies, including irrigation charges that do not cover fully costs and non-payment of water charges, low interest rates and non-payment of credits, low electricity rates and non-payment of electricity charges, and the difference between international and domestic prices of fertilizers, are now equal to about 16% - 17% of the agricultural GDP (higher in the case of wheat and rice) and, correspondingly, about 2.5% of total GDP. Other Government policies have delinked internal and external markets by imposing quantity and/or price controls over exports/imports of agricultural commodities and by "canalizing" the sale of agricultural exports and imports through public corporations. The Government also extends support to agriculture through research and extension programs. Besides such broad interventions, the Government has frequently launched crop-specific programs with more limited objectives.

1.02 The simultaneous implementation of such wide ranging, and sometimes divergent, policies impinges upon farmers' incentives in many complicated and sometimes conflicting ways. Analysts of the impact of Government policies typically have examined their effect on a summary variable -- net income per hectare in a given crop -- in assessing whether the policies in question have stimulated additional output. More sophisticated analyses also consider the opportunity cost of the policy, in terms of the policy-induced substitution between one crop and another. The inclusion of opportunity costs clearly represents an improvement over the simple calculation of net income per hectare. However, both approaches rely on domestic prices in their evaluations. Thus, they implicitly adopt an autarkic view of the agricultural sector and thereby neglect the possiblities of gains from international trade and changes in net foreign exchange earnings.

1.03 Another approach, taken in this study and in recent World Bank work, (Krueger, Schiff and Valdes) is to analyze how agricultural policies affect the differential between domestic prices (adjusted for subsidies and input costs) and international prices. In other words, are certain crops, and agriculture in general, being protected or disprotected (in effect taxed) by the maintenance of prices that diverge from those that would prevail under free international trade? To see the importance of this question, suppose that policies combine to keep the domestic price of

one commodity above the world price (protecting that crop) and prices of a second commodity that could be produced on the same land, below world prices (disprotecting or in effect taxing that crop). Then, from an efficiency standpoint, too much land, labor and capital are being used to produce the first commodity and too little are being used to produce the second. Resources and foreign exchange could be saved by adjusting prices to stimulate a shift of resources from production of the first commodity to the second. Demand could be satisfied and foreign exchange earned on balance by exchanging the increased production of the second crop for imports of the first in international markets.

1.04 The differentials between domestic and international reference prices are measured in this study by three standard ratios, referring to comparisons at three levels of increasing complexity -- nominal protection coefficients (NPCs), effective protection coefficients (EPCs), and effective subsidy coefficients (ESCs). These coefficients are defined below but basically the NPC indicates the incentive to produce a commodity, the EPC indicates the incentive to the use of resources (land, labor and capital) in producing the commodity after deducting the cost of tradeable intermediate inputs, and the ESC adjusts the EPC to take into account taxes and subsidies on non traded inputs (e.g. irrigation, electricity); all relative to what would exist under free trade without taxes and subsidies.

1.05 In calculating the international competiveness of a commodity, transport costs can make a potentially enormous difference. In terms of competing with imports, international transport costs provide a degree of protection for domestic producers. In contrast, exporting means that the domestic producer's price must be low enough to make the product competitive in foreign markets, including transport costs to the market. A simple example will make clear how important this difference is: If international transport costs are $10 per ton and the international price of a good at the foreign point of sale was $100, then domestic producers could compete effectively with imports at the border, providing they produce profitably at a price of $110. However, in order to export, domestic producers would need to be able to produce profitably at a price of $90. Thus, the competitive border price is about 22% higher than the competitive export price. This means that investments in production could easily earn a high economic rate of return as long as domestic production is substituting for imports, but might become unprofitable once it became necessary to capture an export market. Moreover, domestic transport costs can provide additional "natural protection" to production in inland areas.

1.06 To cover this issue of transport costs, the NPCs, EPCs, and EPSs have been calculated under two hypotheses: a) the crop in question is imported and thus competes at the domestic port with imports including their transport cost (the importable hypothesis) and b) the crop in question is exported and thus competes at a foreign port including transport costs (the exportable hypothesis). Thus the two different treatments of transport costs allow the analyst to see whether the Indian producer is competitive with imports given the protection accorded by transport costs and what, if any, subsidy would be required to export the crop. Adjustments are also made for domestic transport costs, as explained in the detailed crop studies.

1.07 In addition to NPCs, EPCs, and EPSs, this study also comments on the size of the price differentials under the assumption that foreign exchange is accorded a notional premium of 25% over the going exchange rate. The inclusion of such a premium is assumed to cover not only the possibility of currency overvaluation under the current trade and payments regime, but also the compensatory change in the exchange rate that would be necessary if all protection were to be eliminated. With the inclusion of such a premium, the coefficients become good proxies for cost benefit indicators such as Domestic Resource Cost (DRC).[1] Finally, the coefficients also are estimated for specific regions and crop varieties to provide some idea of the differences in incentives between regions.

1.08 The Nominal Protection Coefficient (NPC) is defined as the ratio of the domestic price to the world reference price of the commodity under consideration. Symbolically,

$$(1) \qquad NPC = P^D/P^R,$$

where,

NPC = Nominal Protection Coefficient
P^D = Domestic Price of the commodity in question at the farmgate
P^R = Reference Price of the commodity in question, i.e. what the farmer would have received in the case of free trade.

1.09 In this study, the domestic price is approximated either by what the cultivators of the relevant commodity receive or what the Government announces as its support/procurement price; the world reference price is derived from the international price, adjusted for transport cost (both foreign and domestic), and marketing and trading margins, including any processing necessary to make the domestic commodity equivalent to the internationally traded commodity.

1.10 If the NPC is greater (less) than one, then the commodity is protected (disprotected or in effect taxed), compared to the situation what would prevail under free trade. Of course, one needs to compare NPCs across crops and industries and make an adjustment for the premium on foreign exchange to get a better idea of whether the policy regime provides more or less incentives for production of a given crop than under free trade. For example, if the average NPC was 1.4%, then crops with NPCs of 1.4% or more would be receiving an incentive vis a vis other import substitutes; crops with lower NPCs would be receiving an incentive vis-a-vis exportables and, perhaps, non-tradeables.

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[1] See Garry Pursell and Neil Roger and Pasquale L. Scandizzo and Colin Bruce, for further details.

1.11 The Effective Protection Coefficient (EPC) is defined as the ratio of value added at domestic prices to value added[2] at world reference prices. Symbolically,

$$(2) \qquad EPC = VA^D/VA^R$$

$$= (P^D - \text{Sum}(a_{ij}\ P^D{}_j))/(P^R - \text{Sum}(a_{ij}\ P^R{}_j)$$

$$= (P^D - TI^D)/\ ((P^D/NPC) - (TI^D NPC_i)$$

where

VA^D = Value Added in Domestic Prices
VA^R = Value Added measured at International Reference Prices
P^D = Domestic Price of the good in question (the ith good)
P^R = International reference price of the good in question.
a_{ij} = Quantity of the jth input used to produce the ith good

$P^D{}_j$ = Domestic Price of the jth good

$P^R{}_j$ = international Price of the jth good.

TI^D = Sum $(a_{ij}\ P^D{}_j)$
NPC = Nominal Protection coefficient of the good in question
NPC_i = Weighted average of the Nominal Protection coefficients of the tradeable inputs into good i, with the weights equal to the value shares of the inputs in the reference price.

Thus, a prerequisite for estimating EPCs is a detailed knowledge of the input structure of the commodity under consideration and the nominal protection not only on the output but also on its traded (tradeable) inputs.

1.12 Again, a coefficient greater than (less than) one indicates protection (disprotection or, in effect, taxation) compared to the free trade. Effective protection (EPC) will be greater than (less than) the nominal protection (NPC) to the extent that tradeable inputs into the production process have a lower (higher) NPC than the product. Thus the EPC refers to the protection accorded to the land, labor and capital (the value added) used in the production of the commodity in question, while the NPC refers to the protection accorded a commodity, including all the inputs that go into its production. The NPC overstates (understates) the incentive to apply resources to production if the inputs have higher (lower) NPCs than the final product. Hence, the EPC is a better measure of the incentives to produce a commodity than the NPC.

1.13 Finally, the Effective Subsidy Coefficient (ESC) essentially adds net subsidies (subsidies minus taxes) on non-traded (non-tradeable) inputs in the numerator of EPC and divides by value added at world reference

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[2] Value added as used here refers to the difference between the output price and the per unit value of all traded (tradeable) inputs that go to produce one unit of output. Theoretically, the non-traded inputs should be decomposed into their tradeable and primary, non-traded components, and different treatments accorded to both, but in practice such refined treatments are precluded by lack of data.

prices. Symbolically,

(3) $ESC = (VA^D + NS)/VA^R$

Where

NS = Subsidies (net of taxes) on non-traded inputs, and VA^D and VA^R were defined previously.

Net subsidies on traded inputs are already taken into account in their prices and thus are already included in the EPC calculation. The ESC goes a step beyond the EPC in measuring incentives to the use of resources in a crop or a sector, because it takes into account not only protection and subsidies on traded (tradeable) inputs, but also net subsidies on non-traded (non-tradeable) inputs.

1.14 The three estimates of protection coefficients defined above help

(1) to measure the extent of divergence (distortion) between domestic and international prices as a result of the regulatory policies on international trade and domestic markets;

(2) to measure the level and differences in "effective incentives" for cultivators of different crops in different regions. This in turn can throw some light on issues related to equity in the distribution of incentives across regions, as also assist in identifying the causes that lead to faster growth of some crops in certain regions than in others;

(3) to measure comparative advantage and thus degree of competetiveness of various crops in different regions, considering foreign trade as a transformation frontier. This would be valuable information assisting in allocating existing and investment resources more efficiently, and evolving a rational/desirable cropping pattern;

(4) to test the hypothesis of underpricing of agriculture in developing countries (Schultz, 1978) and to measure the extent of bias against agriculture and in favour of industry.

B. Estimation of Protection Coefficients and Results

1.15 Four commodities are covered in this study: wheat and rice, India's most important cereals; cotton, an important cash crop used in the country's large textile industry; and groundnut as a representative of the oilseeds crop complex. Together, these four crops account for roughly 45 per cent of gross cropped area and above 50 per cent of gross value of crop output. Wheat, rice and cotton experienced technological breakthroughs during late 1960s and 1970s in certain regions, while groundnut has lagged behind. Presently, efforts are being made to stimulate oilseed production under the Technology Mission on Oilseeds launched by Government of India in 1986 and a buffer stock/price support scheme was introduced in 1989.

1.16 Tables 1.1 and 1.2 summarize the estimates of the protection coefficients for each of these crops for the 1980s (1980-81 to 1986-87), for the major producing states and crop varieties, under both the importable and exportable hypotheses[3]. Details on the individual crops are found in Chapters 2 (wheat and rice), 3 (cotton) and 4 (groundnuts) and the references cited there.

1.17 Starting first with the incentives for crops as import substitutes (the importable hypothesis), the crop-specific NPCs[4] for the period 1980/81 to 1986/87 were lowest in case of rice (0.67) and highest for groundnut (1.50) (See Table 1.1). Wheat and cotton fall in between, with both having NPCs of 0.80. Across states, the lowest NPC is for Andhra Pradesh cotton (MCU-5 variety, NPC=0.63), followed by rice in Bihar and Orissa (NPC=0.65). In sum, domestic prices of rice, wheat, and cotton were all well below comparable world prices, indicating disprotection or effective taxation of these commodities compared to border prices. In contrast, groundnut was highly protected. The relative incentive provided for groundnuts by the policy regime and the delinking from international markets is more than 123% higher than for rice.

1.18 Turning to effective protection (under the importable hypothesis), the EPCs for wheat, rice, and cotton all were less than the coresponding NPCs. This is because tradeable inputs used in these crops were protected, while the crops themselves were disprotected. The difference between the EPC and the NPCs is greatest in the case of cotton (13.75%) and smallest in the case of rice (2.98%). The large difference between the EPC and NPC in cotton, especially that of Gujarat (by 31.5%), reflects the large share of tradeable inputs, primarily pesticides, in the production of cotton, and the fact that NPC of pesticides is much higher than NPC of cotton. On the other hand, the protection on groundnuts was

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[3] In the case of wheat, the coefficients are estimated separately for four states - Uttar Pradesh, Punjab, Haryana and Madhya Pradesh. Fair Average Quality (FAQ) of domestic wheat, as categorised by Food Corporation of India, is compared with US Hard Red Winter No. 2 with ordinary protein. In the case of rice, the coefficients are calculated for Andhra Pradesh from the south, Bihar and Orissa from the east, Punjab and Uttar Pradesh from the north and Madhya Pradesh from the central region. Indian "Common" (FAQ) rice is compared with Thai (Milled) white, 5 per cent Broken. The protection coefficients for Cotton are worked out for Maharashtra, Gujarat, Punjab and Andhra Pradesh. In case of Maharashtra Hybrid-4 variety is compared with its like Mexican cotton; Gujarat's Shankar-4/6 is compared with California (SM 1 1/8"), Punjab's J-34/320F is compared with Orleans/Texas (1") and Andhra MCU-5 with Giza 67/69/81. In case of groundnut, protection estimates are for Gujarat, Andhra Pradesh and Tamil Nadu.

[4] The crop specific NPCs were calculated as a weighted average of the state NPCs, with value of the crops in the states used as the weights.

Table 1.1: Crop and Region-Specific Dispersion of Effective Incentives in Indian Agriculture (Average 1980-81 to 1986-87)

Hypothesis/Crop/State	NPCs	EPCs	ESCs	Index of ESCs (weighted Average=100)	ANPCs	Crop Variety: Domestic	Crop Variety: International
Importable Hypothesis							
WHEAT							
Haryana	0.84	0.79	1.03	110.75	0.66	FAQ	Hard Red Winter No. 2
Madhya Pradesh	0.75	0.73	0.96	103.22	0.60	-do-	with ordinary protein (USA)
Punjab	0.85	0.80	0.93	100.00	0.66	-do-	-do-
Uttar Pradesh	0.77	0.73	0.91	97.85	0.62	-do-	-do-
Weighted Average	0.80	0.75	0.93	100.00	0.63	-do-	-do-
RICE							
Andhra Pradesh	0.69	0.66	0.88	100.00	0.55	Common	Thai White (Milled) 5% Broke
Bihar	0.65	0.64	0.86	97.72	0.52	-do-	-do-
Madhya Pradesh	0.67	0.65	0.85	96.59	0.53	-do-	-do-
Orissa	0.65	0.63	0.84	95.45	0.52	-do-	-do-
Punjab	0.74	0.72	1.01	114.77	0.58	-do-	-do-
Uttar Pradesh	0.66	0.64	0.85	96.59	0.52	-do-	-do-
Weighted Average	0.67	0.65	0.88	100.00	0.54	-do-	-do-
COTTON							
Maharashtra	0.96	0.93	0.98	103.67	0.74	H-4	Mexican
Gujarat	0.89	0.61	0.67	89.33	0.68	S-4/6	California (SM 1 1/8")
Punjab	0.83	0.74	0.86	114.67	0.64	J-34/320F	Orleans/Texas (1")
Andhra Pradesh	0.63	0.54	0.55	73.33	0.50	MCU-5	Giza-67/69/81
Weighted Average	0.80	0.69	0.75	100.00	0.62		
GROUNDNUT							
Gujarat	1.47	1.59	1.70	99.41	1.17		
Andhra Pradesh	1.50	1.54	1.72	100.58	1.18		
Tamil Nadu	1.53	1.55	1.73	101.17	1.21		
Weighted Average	1.50	1.56	1.71	100.00	1.18		
Exportable Hypothesis							
WHEAT							
Punjab	1.34	1.71	2.01		0.98	FAQ	Hard Red Winter No. 2 (USA)
RICE							
Punjab	0.87	0.87	1.21		0.66	Common	Thai White (Milled) 5% broke
COTTON							
Maharashtra	1.13	1.12	1.17	132.95	0.86	H-4	Mexican
Gujarat	1.10	0.74	0.81	92.04	0.78	S-4/6	California (SM 1 1/8")
Punjab	0.98	0.89	1.04	118.18	0.75	J-34/320F	Orleans/Texas (1")
Andhra Pradesh	0.67	0.56	0.58	65.91	0.53	MCU-5	Giza-67/69/81
Weighted Average	0.92	0.80	0.88	100.00	0.71		
GROUNDNUTS							
Gujarat	1.87	2.48	2.60	105.26	1.45		
Andhra Pradesh	1.91	2.15	2.42	97.97	1.48		
Tamil Nadu	1.95	2.13	2.38	96.36	1.51		
Weighted Average	1.91	2.26	2.47	100.00	1.48		

Source: Gulati (1988)

greater than the protection on inputs into groundnut production, making the effective protection (EPC) of groundnut greater than the nominal protection. In sum, for wheat, rice, and cotton the prevalence of EPCs that are below one and below the corresponding NPCs show that the combined effect of the policy regime, including the protection accorded industrial goods, has discouraged resource use in these crops, relative to a free trade regime. However, the policy regime has stimulated the allocation of resources to groundnuts.

1.19 Not surprisingly, the adjustment for subsidies on non-tradeable inputs such as irrigation (canal), electricity and credit and the low level of agricultural taxes (ignored here), produce ESCs that are higher than the respective EPCs. The largest increase occurs in case of rice (by 35.4%) and smallest in case of cotton (by 8.7%). The adjustment for subsidies also changes the ranking of incentives to the various crops. Whereas on the NPC and EPC scales, rice received the lowest protection (the largest rate of effective taxation), on the ESC scale it is cotton that appears with the lowest protection, with an ESC of 0.75 compared to 0.88 for rice, 0.93 for wheat and 1.71 of groundnut. The difference between the highest and lowest ESCs is marginally greater (128%) than for the NPCs (123%), but is lower than that of the EPCs (140%).

1.20 The spatial dispersion of ESCs is maximum in case of cotton, with Maharashtra's ESC (0.98) 78% higher than that of Andhra Pradesh (0.55). Across all states and all crops, the highest ESC is that of Tamil Nadu for groundnut (1.71) and the lowest of Andhra Pradesh for cotton (0.55).

1.21 Adjusted NPCs (ANPCs) can be estimated for these crops by assuming a notional premimum on foreign exchange, in this case 25%. The pattern of ANPCs and NPCs is of course similar, but ANPCs are much lower than NPCs. This has important implications discussed in section C.

1.22 Turning to the possiblity of exports (the exportable hypotheses), protection coefficients are generally much higher than under the importable hypothesis. This reflects the fact that under the exportable hypothesis shipping costs are deducted from world prices before comparison with domestic prices, while for imports, shipping costs are added to world prices. Obviously, the higher the share of transport cost in the output price, the greater the deviation in protection coefficients between the exportable and the importable hypotheses. Estimated shipping costs also reflect the distance between Indian ports and the foreign lands where Indian goods are assumed to compete. In case of wheat, for example, Indian exports are assumed to compete with U.S. wheat in the Meditteranean/Black Sea area. The deviation in results under the importable and exportable hypotheses is therefore much greater than in the case of rice, where competition is assumed to be near Calcutta, in the strait of Malacca. Similarly, groundnut estimates diverge by more than cotton estimates, because in the former case exports are assumed to be delivered to Europe (Rotterdam) while in the latter Japan is assumed to be the marketplace.

Table 1.2: Temporal Behaviour of Crop-Specific Effective Incentives and Prices in Indian Agriculture[1]

Hypothesis/Crop/Protection Coefficient	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Temporable Hypothesis								
WHEAT								
NPCs	0.72	0.73	0.84	0.84	0.76	0.76	0.91	0.80
EPCs	0.67	0.68	0.80	0.80	0.72	0.72	0.89	0.75
ESCs	0.76	0.85	0.99	0.99	0.90	0.90	1.12	0.93
AEPCs	0.57	0.58	0.67	0.67	0.60	0.60	0.73	0.63
Domestic Price/a (Rs/q)	117	130	142	151	152	157	162	
World Price/b (Rs/q)	127	148	152	159	170	173	145.	
Price Ratio	0.92	0.88	0.93	0.95	0.89	0.91	1.12	0.94
RICE								
NPCs	0.45	0.51	0.75	0.70	0.72	0.78	0.80	0.67
EPCs	0.43	0.48	0.73	0.68	0.70	0.78	0.78	0.65
ESCs	0.58	0.65	0.99	0.90	0.96	1.01	1.06	0.88
AEPCs	0.36	0.40	0.60	0.56	0.57	0.63	0.64	0.54
Domestic Price/c (Rs/q)	150	164	174	189	196	203	208	
World Price/d (Rs/q)	353	355	255	291	293	274	274	
Price Ratio	0.42	0.46	0.68	0.65	0.67	0.74	0.76	0.63
COTTON								
NPCs	0.77	0.94	0.82	0.68	0.73	0.86	0.83	0.80
EPCs	0.66	0.82	0.71	0.58	0.62	0.74	0.69	0.69
ESCs	0.71	0.90	0.79	0.64	0.67	0.82	0.75	0.75
AEPCs	0.60	0.72	0.64	0.53	0.57	0.66	0.64	0.62
Domestic Price/e (Rs/q)	895	1118	1118	1176	1206	1250	1264	
World Price/f (Rs/q)	1629	1415	1594	1949	1727	1333	1734	
Price Ratio	0.55	0.79	0.70	0.60	0.70	0.94	0.73	0.72
GROUNDNUT								
NPCs	1.06	1.37	1.66	1.41	1.40	1.53	2.05	1.50
EPCs	1.09	1.44	1.74	1.47	1.47	1.58	2.13	1.56
ESCs	1.20	1.55	1.93	1.58	1.60	1.76	2.32	1.71
AEPCs	0.84	1.08	1.31	1.11	1.11	1.21	1.63	1.18
Domestic Price/g (Rs/q)	294	386	421	450	486	500	528	
World Price/h (Rs/q)	382	539	389	396	497	445	409	
Price Ratio	0.77	0.72	1.08	1.14	0.98	1.12	1.29	1.01

(contd.)

Table 1.2: Temporal Behaviour of Crop-Specific Effective Incentives and Prices in Indian Agriculture[1]

Hypothesis/Crop/Protection Coefficient	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Exportable Hypothesis								
WHEAT								
NPCs	1.15	1.09	1.24	1.29	1.27	1.33	1.99	1.34
EPCs	1.29	1.16	1.35	1.47	1.55	1.71	3.44	1.71
ESCs	1.57	1.35	1.57	1.73	1.81	2.00	4.07	2.01
ANPCs	0.87	0.83	0.93	0.96	0.93	0.97	1.38	0.98
RICE								
NPCs	0.50	0.60	0.94	0.89	0.94	1.09	1.18	0.87
EPCs	0.47	0.57	0.93	0.88	0.95	1.13	1.19	0.87
ESCs	0.65	0.77	1.26	1.21	1.30	1.60	1.68	1.21
ANPCs	0.39	0.46	0.70	0.68	0.72	0.83	0.87	0.66
COTTON								
NPCs	0.89	1.13	0.92	0.74	0.83	1.01	0.93	0.92
EPCs	0.78	1.04	0.80	0.62	0.71	0.89	0.79	0.80
ESCs	0.84	1.13	0.88	0.69	0.78	0.99	0.86	0.88
ANPCs	0.70	0.87	0.72	0.58	0.64	0.76	0.72	0.71
GROUNDNUT								
NPCs	1.25	1.72	2.03	1.69	1.76	2.03	2.87	1.91
EPCs	1.44	2.09	2.44	1.90	2.07	2.36	3.45	2.26
ESCs	1.57	2.24	2.69	2.04	2.31	2.63	3.76	2.47
ANPCs	0.99	1.34	1.57	1.32	1.37	1.56	2.20	1.48

Notes: /a Domestic price of wheat is approximated by its procurement price for FAQ.
/b World price is of US Hard Red Winter No. 2 with ordinary protein, fob US gulf (at official exchange rate) for April to June quarter.
/c Domestic price of rice is estimated as procurement price of paddy divided by 0.7, which is paddy-rice conversion factor for Indian 'Common' rice.
/d World price of rice is of Thai white (Milled) 5% Broken, fob Bangkok (at official rate) for October to January.
/e Domestic price of cotton is approximated by procurement price of kapas (J-34/414F/H-777 variety) divided by 0.34, which is kapas-lint conversion ratio.
/f World Price of cotton is that of cotton outlook index 'A', cif Liverpool.
/g Domestic price of groundnut is its procurement price (in terms of Kernels).
/h World price of groundnut is of Kernels of any origin, cif Europe (Rotterdam).

1.23 Except for cotton, the ESCs under the exportable hypothesis are higher than unity for all crops. Even in case of cotton, the ESCs are above unity for Maharashtra and the Punjab (Table 1.1). The average ESC is lowest for cotton (0.88) and highest for groundnut (2.47), with rice (1.21) and wheat (2.01) falling in between. Across all states and crops under consideration, Gujarat goundnut has the highest ESC (2.60) and Andhra Pradesh cotton the lowest ESC (0.58). The percentage difference between the highest and lowest ESCs under the exportable hypothesis (348%), is much higher than under the importable hypothesis (215%). These results suggest that cotton, particularly Andhra Pradesh cotton, is an efficient export. Cotton from other states and rice also would be efficient exports with a foreign exchange premium of 25%.

1.24 Crop-specific protection coefficients have tended to rise over the seven year period 1980-81 to 1986-87 (Table 1.2), suggesting that the disprotection of agriculture has been reduced in the 1980s. Under the importable hypothesis, for example, ESCs of wheat rose from 0.76 to 1.12; ESCs of rice rose from 0.58 to 1.06; ESCs of cotton rose from 0.71 to 0.75 and ESCs of groundnut rose from 1.20 to 2.32. Thus, the maximum increase took place in the case of groundnut (by 93.33%), followed by rice (by 82.76%). In fact in all cases except cotton, ESCs in 1986-87 were above unity. For cotton, rice and wheat the rise is largely explained by the declining trend in world prices, not offset by the devaluation of the rupee. Domestic prices (in rupees) rose about 5-6% p.a. about the same as the wholesale price index in general. In the case of groundnut, domestic prices rose about 10% p.a., owing to the growing demand-supply imbalance in the domestic edible oil economy; this contributed to the rising protection for groundnut along with the fall in international prices.

C. Implications and Concluding Remarks

1.25 The results of present study suggest following implications:

1. Efficient Import Substitutes: Three of the four agricultural commodities- wheat, rice and cotton - appear to have been efficient import substitutes. The protection coefficients of these crops are below unity in almost all years in the 1980s. In contrast, for groundnut the coefficients suggest substantial protection. A foreign exchange premium in excess of 40% would be needed to make groundnuts an efficient import substitute. This result suggests that perhaps too many resources were being devoted to groundnut production in the 1980s, while too few were being devoted to cotton, wheat and rice. This is particularly true in areas where these crops compete directly for resources, such as parts of Gujarat and Andhra Pradesh. A switch of resources out of groundnuts, into the other three crops, brought about by a shift in relative prices, probably would have increased efficiency and net foreign exchange earnings.

2. High Economic Rate of Return in Agriculture, Particularly Cotton, Wheat and Rice Investment programs aimed at increasing the production of wheat, rice and cotton appear to have had high economic rates of return during 1980s. This is suggested particularly by the "adjusted" protection coefficients -- adjusted for overvaluation of exchange rate -- which are significantly lower than the unadjusted coefficients, and which would be close to cost-benefit indicators such as Domestic Resources Cost (DRC). In particular the economic rates of return are likely to be higher than those prevailing in the industrial sector, where protection coefficients generally fall into a much higher range (see World Bank 1987, Chapter 4).

In this regard, long staple cotton in Andhra Pradesh deserves special mention. It appears that the technological breakthrough that took place in Andhra's cotton economy, resulting in a phenomenal rate of growth in yields, offers an opportunity to reap high economic return on investment. Closer linkage with the world economy would thus be desirable from an efficiency standpoint. Of course the resulting rise in cotton's price would raise domestic prices of cotton textiles.

Investment in long staple cotton deserves priority from another angle. While in the case of other commodities, the ESCs under the exportable hypothesis exceed unity, in the case of cotto.. they are below unity. Hence, cotton production can be increased faster than its domestic demand, the excess making an efficient export.

In contrast, increases in wheat and rice production are likely to be efficient up to the point that these crops remain import substitutes, but the efficiency of exporting these crops is less clear. A foreign exchange premium of at least 25% would be needed to make rice an efficient export. This implies that planners should aim to increase production of wheat and rice basically in line with their domestic demand, with some scope for rice exports. In view of this result, the Special Rice Programme launched by Government of India in eastern states during mid-1980s, seems a promising investment.

Investment in groundnuts appears to be a less attractive proposition from the standpoint of economic rates of return. In this context it may be remarked that large investments under the the Technological Mission on Oilseeds would require a high implicit weight for the objective of self-sufficiency, as their justification on purely economic grounds is low.

In calculating economic rates of return, due consideration must be given to subsidies. In particular, rice, which is a water intensive crop, has a much higher economic rate of return in high rainfall areas like Bihar and Orissa (with low ESCs) than in the Punjab-Haryana belt. In fact, if one simulated a scenario where electricity and water are appropriately shadow priced in the low rainfall areas of north-western India (Punjab-Haryana), the results might well suggest diverting resources away from rice cultivation, to less water intensive crops such as maize.

3. Inter State and Inter-Crop Differences in Effective Incentives
The calculations of protection coefficients across states (not shown) indicate at least two significant spatial variations: 1) Punjab rice has a much higher NPC, EPC, and EPS than the other states, reflecting higher prices and, the irrigation subsidy; 2) Maharashtra cotton (and to a lesser extent Punjab cotton) received much higher protection and Andhra cotton received much lower protection than the average for cotton, reflecting differences in procurement price policy during the period and, to a lesser extent, irrigation subsidies.

4. Input Subsidies and Effective Incentives: In most cases, subsidies on non-tradeable inputs are large and adjustment for subsidies consequently leads to ESCs significantly higher than EPCs. For the crops covered here, estimated subsidies on non-traded inputs range from 8% in cotton and 13% in groundnuts to 24% in the case of wheat and over 30% in the case of rice. For the agricultural sector as a whole, subsidies amount to about 16%-17% of value added (Gulati 1988a) and the equivalent of over 2.5% of GDP. With subsidies of this magnitude, NPCs or even EPCs may not be good proxies for effective incentives. This seems to be particularly true in the case of canal irrigated crops. The studies in this report and elsewhere (Gulati 1988a) suggest that subsidies on canal irrigation, because of charges that do not cover costs and because of non-payment of charges, are quite large. In fact, they represent roughly 70 per cent of total estimated input subsidies including electricity, credit and fertilizers. The estimates of subsidies on other non-traded inputs represent a much smaller portion of output price, though in terms of GDP or government budgets, they may be relatively large.

Given the Government's large fertilizer subsidy, this statement requires some additional explanation. First, since fertilizer is traded, this subsidy is already taken into account in the EPC, to the extent the fertilizer subsidy lowers domestic fertilizer prices below international levels. Second, the Government's fertilizer subsidy, which looms large in the budget, lowers Indian fertilizer prices only somewhat below world prices in the 1980s; part of the subsidy goes to ensure that fertilizer plants could operate profitably at these prices. (See chapter 2, Section B). The portion of the subsidy going to fertilizer producers obviously does not affect agricultural incentives.

Although further work on subsidies is necessary, the relatively small size of the non-irrigation subsidies suggests the possibility that their reduction would not have a large impact on price. This is even more so given the fact that these subsidies are generally not received by many farmers and hence may not affect the cost of the marginal farmer. (See para 1.26-3). In case of canal irrigated crops, it appears that best policy would involve a combination of better collection of higher charges and evolution of a cropping pattern that relies more on crops requiring little water.

5. Export Subsidies: Cotton, especially long staple cotton, can compete in international markets effectively without any export subsidies. What is required is a change in policy environment, particularly the quantitative restrictions on exports. Of course, this would increase the domestic price of cotton and lead to an increase in the price of cotton textiles.

Punjab common rice cannot be exported under the current policy regime without export subsidies. However, if foreign exchange is given a 25% premium, then Punjab rice could become an exportable, depending on the international price. During the second half of 1980s, even after allowing for this premium, Punjab rice was not competitive with Thai rice in international market because of the fall in the price of Thai rice and a rise in the domestic price of common rice. Also, if electricity and canal water were appropriately shadow-priced in the Punjab (see para 2.52), then its rice could well cease to be an efficient exportable.

Wheat and groundnut probably cannot be considered efficient exportables. Both have ESCs greater than two. Punjab wheat would have required a substantial export subsidy, especially during 1985-86 and 1986-87, to compete with US wheat in international markets. It may be observed that in 1986-87, the ESC of Punjab wheat was as high as 4.07, almost eliminating any possibility of wheat exports. Groundnuts, with an ESC=3.76 in 1986-87 also was not an efficient export.[5]

6. Underpricing of Agriculture The weighted average ESCs (averaged over the 7 years under consideration) for wheat and rice cultivators, who operate on more than one-third of gross cropped area, are below unity. The ESCs are even lower for cotton. These results support the thesis that agriculture is underpriced in developing countries due to their bias in favour of newly emerging industrial sector (Schultz, 1978). The results are similar to those reported in the recent study of Krueger, Schiff, and Valdes. As in their study, exported products (cotton) were in effect taxed in India by delinking domestic sales from international markets, while imported food products (edible oils, of which groundnut is a major component) receive substantial direct protection. Factoring in a premium for foreign exchange[6] reduces the protection of edible oils (groundnut), but it means the "distortion" in the price of cotton, and of rice and wheat is much greater than shown by the unadjusted coefficients.

7. Bias against Rice Cultivators: Of the two major crops of Indian agriculture - wheat and rice - weighted average ESCs are lower in the case of rice than of wheat. This is true almost for all years and all states, except for the Punjab. In case of Punjab, and presumably of Haryana (not analyzed here), ESCs for rice cultivators are higher than those for wheat cultivators. These results, therefore, seem to be in line with Mitra's thesis of a bias in Indian agricultural price policy. Mitra, while analyzing domestic terms of trade, remarked that Indian agricultural price policy had a bias in favour of

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[5] Some exports of groundnut meal occurred in the 1980s, but they went almost wholly to the Soviet Union and the other Eastern Bloc countries, where prices of groundnut and groundnut oil may be substantially higher than in world markets. Another factor in these exports may be the accounting rates of coversions used for the inconvertible currencies in which this trade is conducted.

[6] Krueger, Schiff, and Valdes call this the indirect protection effect. As discussed above, it arises from a) overvaluation of the currency and b) the compensating change in the exchange rate that would be necessary to offset the elimination of protection throughout the economy.

wheat growing cultivators of Punjab-Haryana belt and against rice cultivators of eastern India (See Mitra, 1977). Somewhat similar results emerge out of our study, through a different methodology. However, there is one important difference in our study: that rice cultivators of the Punjab (and Haryana) are more protected than wheat cultivators of the Punjab (and Haryana).

1.26 This report raises a number of issues that require further study:
1. The source of the international competitiveness or uncompetitiveness of India's agricultural products: Simply put, why is cotton exportable, with prices below world levels, and why are groundnuts so expensive compared to imports? On one level the answer is that it is not products but the marginal producers that are competitive or uncompetitive. The delinking of international and domestic markets has allowed Indian domestic prices to diverge from international prices. To the extent that domestic prices have become higher (lower) than international prices, then more (less) resouces have been allocated to the production of the products than would have occurred had free trade prevailed and production has moved into areas that are perhaps not fully suited to some crops.[7] Correspondingly, this has reduced production of crops that are more competitive internationally. Linking domestic markets more closely to international markets would mean that domestic and international prices would come closer together - in the limit they would be the same. This would mean that the domestic producers of all crops would be competitive. Of course, it also would mean a shift from the current allocation of resources among crops. Resources would shift out of the crops now receiving protection, leaving production only in areas that can better compete internationally; Resources would shift into the production of crops that had been disprotected.

On another level the question is what can be done to make Indian crops more competitive. The foregoing results are indicative of static inefficiencies, resulting from relative price distortions, but what do they say about investment? As noted above, when EPCs and ESCs are adjusted for the shadow price of foreign exchange and projected over time, they serve as good proxies for such cost benefit indicators as DRCs (Domestic Resource Costs)[8], and thus are suggestive of the relative returns from investment in different crops.

It is also true that these indicators only reflect existing technology, and do not indicate what might happen if the technology changed, for example, if a high yielding groundnut variety were developed. However, this point should not be taken as an argument for protection of certain crops in order to develop new varieties (a variant of the infant industry argument). The linkage between high prices and development of new seed varieties is even more tenuous in India than elsewhere, given the delinkage of the India's research & extension services from market signals. If such high yielding varieties are developed by Indian or foreign researchers, then arguments might be made for a favorable price

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[7] This shows up quite clearly in a recent study on natural rubber (Mani, 1989). Rubber production is competitive with Malaysian rubber only in a small part of Kerala, but protection and subsidies allowed production to extend into climatically less suitable zones.

[8] See Pursell and Roger and Scandizzo and Bruce.

policy, in order to stimulate rapid dissemination. In the meantime, however, there is no dynamic rationale to engage in a protective price policy that will result in static inefficiency.

2. The role of Processing and Marketing in Competitiveness The analyses of protection coefficients reflect two elements on the domestic side:

a) relative crop yields adjusted for relative costs of land, labor, and capital and the exchange rate -- even if Indian yields are low, lower prices of Indian factors of production (in foreign currency, could leave Indian agricultural output competitive in world markets;
b) cost of transport, marketing and processing (very few agricultural products enter the world market in a completely unprocessed state).

To the extent that marketing, transport, and processing margins are high in India, the price at the farmgate is squeezed and Indian products tend to appear uncompetitive with imports and too high priced to be exported. For example, in the edible oil complex, marketing and processing costs are high by international standards. Moreover, the collection and transport methods contribute to the aflatoxin problem for groundnut and thereby make Indian production of groundnut less competitive internationally. This problem affects not only groundnut kernels, but the by-products from refining groundnuts, which elsewhere can be sold for cattle-feed, but which in India contain high levels of aflatoxin. Another example of the importance of trading margins is found in a recent study of the export potential of agriculture for fresh vegetables (Bombay Chamber of Commerce). The study shows that wholesale margins represent 60-80% of the f.o.b. Bombay price and farmgate prices only 20-40%. Hence, there seems to be great scope for making Indian agricultural products more competitive by increasing the efficiency of processing and distribution, as well as by increasing agricultural yields.

3. The impact of subsidies on incentives, resource allocation, and distribution As described above, the estimated subsidies represent a large fraction of the costs of production of the four crops under consideration. In calculating the ESC incentive measure, subsidies are treated as equivalent to raising the price by the proportionate amount of the subsidy, although subsidies actually lower the cost of production and thus the price that is needed to cover costs. However, there are three considerations that make the impact of subsidies somewhat different than a price rise.

First, most of the subsidies are not available to all farmers, only to those with access to inputs such as canal water, power lines, and bank loans. In most cases the subsidies do indeed lower the cost of the favored producers[9]. This encourages the subsidized farmers to use more resources and to produce more. However, the impact of the subsidy on total output of the crop or domestic prices will depend not only on the extent to which the subsidized farmers expand their production but also the extent to which their additional production simply

[9]In the case of credit, lower interest rates may not lower costs; the credit that is obtained may be used elsewhere, or simply substitute for the farmer's own funds that he would have used in the same crop anyway.

displaces part of the output of unsubsidized farmers. To the extent that total output remains roughly constant, the main impact of the subsidy will be to create higher incomes for the subsidized farmers, rather than to increase output or lower prices. This suggests that an increase in the support price, available to all farmers, probably would increase output more and affect the income distribution less than a similar proportionate subsidy to a few farmers.[10] Second, the subsidies would accrue to any crop produced by the subsidized farmer. Of course their impact on different crops would vary, depending on the intensity of use of the subsidized inputs in a particular crop. The subsidies may even induce farmers to shift from one crop to another, to take advantage of the subsidy. However, this means that the ESC calculations, while useful in comparing the incentives relative to world prices, are perhaps less useful in comparing the relative domestic incentives to different crops. Third, in order to access the subsidized inputs, it may be necessary for farmers to make payments outside normal channels, for example payments to canal operators to receive releases of canal water. Thus, the true costs of these inputs to the farmer may be greater than estimated here and the provision of these inputs to farmers at prices below cost would mainly affect the distribution of income and not incentives. The foregoing three points suggest that the impact of the "subsidies" on prices and output may be less than what might be expected and their impact on rural income distribution may be greater. Further work on subsidies is needed to analyze their actual impact.

4. India's Potential Influence on World Market Prices The estimates of protection/incentives described above treat world market prices as independent of the volume of India's sales or purchases. However, large scale buying or selling could alter world prices. In some cases this may be important for countries like India. For example, the world rice market is relatively small and India's entry either as a large importer or exporter could disturb world prices substantially. Adjusting for this possiblity would mean that under the importable hypothesis the protection coefficients for rice should be even lower, i.e. Indian rice is an even more efficient import substitute than shown above and therefore investment in rice would have even higher economic rates of return. At the same time, exports would be less attractive than shown above, because additional Indian exports would lower the price. These considerations should not, however, be overstated. First there is the question of how much extra rice, or other commodities, would be produced and exported with a shift in relative prices, i.e. what is the domestic supply elasticity of output. Second, additional trade would in general be beneficial, even taking into account the effect of additional Indian sales or purchases on price. However, the standard optimum tariff models suggest that it may not pay for India to go to completely free trade[11] in cases where it affects the international price significantly.

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[10] The reduction in fertilizer price is available to all farmers and would affect output more like an across the board price rise.

[11] See for example Johnson. In the simplest partial equilibrium model, free exports are preferable to autarky, provided the elasticity of demand for the product is greater than the share of the country in world exports of the commodity, although some restriction of trade will lead to still higher benefits for the country.

CHAPTER 2

INDIA: EFFECTIVE INCENTIVES FOR AGRICULTURE THE CASE OF WHEAT AND RICE

Introduction

2.01 Incentives to cultivators of wheat and rice flow through various Government policies, of which output and input pricing are important instruments. The switch towards such a positive price policy since the inception of Agricultural Prices Commission (APC) and Food Corporation of India (FCI) in 1965 played its due role in faster adoption of HYV seeds during the Green (Wheat) Revolution of late 1960s. More recently, a long term agricultural price policy has been announced which seeks to make Indian farm sector "more vibrant, more productive and more cost effective, and to integrate it more closely in the strategy for balanced national development".[1] The policy of minimum support/procurement prices, in effect extends an insurance cover to farmers against the risk of sudden and precipitous fall in the prices of their produce, also encouraging wheat and rice production.

2.02 Input pricing, on the other hand, directly affects farmers' incentives through sizeable subsidies that are offered on vital inputs. Economic subsidies on fertilizers, irrigation, electricity and credit - four key inputs of modern agriculture, touched Rs. 118 billion in 1986-87[2] which represents an estimated 16 to 17 percent of agricultural GDP. (Gulati 1988a).

2.03 Besides the pricing instrument, the Government also uses several other instruments that affect farmers' incentives. For example, the Government has planned to foster a second Green Revolution in the eastern region of India (eastern Uttar Pradesh, Bihar, Orissa and West Bengal) through a package of incentives, that are largely non-price in nature. Distribution of fertilizers and certified seeds (in small packs) through an extensive marketing network, involving the establishment of large number of sales outlets, and regulated markets for the purchase of outputs, is accorded a higher priority that the price factors under this scheme.[3] The Government seems to be following a somewhat similar strategy (supply push) in its latest Action Plan for foodgrain production, where 169 districts have been selected for a "big push" in rice, wheat, maize, gram and arhar production.[4]

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[1] Agricultural Price Policy - A Long Term Perspective, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, 1986.

[2] For greater details on the definition and estimation of economic subsidy as different from financial subsidy, see Ashok Gulati, 1988a.

[3] See Report of Study Group on Agricultural Strategies for Eastern Region of India, Planning Commission, Government of India, July 1985; and Report of the Committee on Agricultural Productivity in Eastern India Reserve Bank of India, 1984.

[4] See Framework Action Plan for Foodgrain Production (Report of the Task Force), Planning Commission, GOI, March, 1988.

2.04 Besides these incentives, Indian cultivators also benefit from extension service programmes. Government, through its various agricultural universities and research institutions, provides extension service to farmers with a view to educate them about the most appropriate farming practices.

2.05 All such direct and indirect incentives that farmers receive through the Government and the market mechanism, appear to converge into a common factor, which seems to be the one most relevant from farmers' point of view, namely net income per hectare. The net income of cultivators from any particular crop, for the same year, differs across different states due to numerous factors ranging from differentials in land productivity to uneven distribution of various Government incentives. For example, in 1983-84 the net income per hectare (measured as the difference between value of output minus cost) of wheat cultivators was Rs. 2684 in Bihar, Rs. 2174 in Punjab, Rs. 2007 in Rajasthan and Rs. 1583 in Haryana. Similarly, paddy cultivators had net income per hectare of Rs. 1946 in Andhra Pradesh, Rs. 1867 in Assam, Rs. 2636 in Bihar, Rs. 3813 in Karnataka, Rs. 1570 in Madhya Pradesh, Rs. 2334 in Orissa and Rs. 1869 in Uttar Pradesh.

2.06 Knowledge of the crop and region specific incentive structure, as revealed by net incomes per hectare, is essential for a policy maker trying to attain a rational/desirable cropping pattern. But this knowledge remains incomplete as these estimates essentially emerge from the autarkical nature of economy and are devoid of any consideration of the role that international trade plays (or can play) in directing optimal allocation of resources across crops and regions, within farm sector. Nor do these estimates explicitly bring out the impact of input subsidies on level and structure of incentives for different crops in different regions. Thus, the crude measure of net income per hectare is severely handicapped and appears to be a rather distorted indicator of incentive structures, which may direct the policy maker towards sub-optimal allocation of resources within agriculture. A more comprehensive approach would require the decision maker to go beyond the realm of autarky and examine the issue of crop and region-specific incentives in agriculture including the international perspective. It is precisely this gap in analytical information that this paper aims to bridge. Accordingly, it explores the question of "effective" incentives from a global angle and inquires : Where does the Indian cultivator stand vis-a-vis world price situation? Is he being net "subsidised" or net "taxed" in relation to what he would have got from his produce under a hypothetical situation of free international trade of inputs and outputs of agricultural sector?

2.07 The primary objective of this chapter is thus to quantify the average level and regional diversity of effective incentives for Indian wheat and rice cultivators during the 1980s. Effective incentives are defined in terms of the "effective protection" accorded to domestic cultivators from their international competitors. The level of effective

protection reflects policy instruments ranging from agricultural trade policy to domestic agricultural price policy. Three different variants of protection coefficients - Nominal Protection Coefficients (NPCs), Effective Protection Coefficients (EPCs) and Effective Subsidy Coefficients (ESCs), are estimated for different states.

2.08 The weighted average protection coefficients of wheat and rice across the states generally have remained below unity in the seven years - 1980-81 to 1986-87. This suggests that both wheat and rice cultivators, on an average, have been "disprotected" during 1980s, relative to c.i.f. import prices. Put another way, the levels set for domestic wheat and rice prices in the 1980s "taxed" these commodities, relative to international prices adjusted for trade and transport margins. Since even these domestic prices resulted in a large buildup of government stocks, one might imagine that the prices that would have equated consumer demand and production would have been even lower. This also suggests that the price policy was a compromise between increasing returns to farmers and not incurring too great an expenditure on subsidizing wheat and rice prices through the Public Distribution System. The figures also suggest that rice cultivators have been "taxed" more than wheat cultivators.

2.09 Based on this analysis, rice and wheat seem to be efficient import substitutes; expansion of their production in line with the growth in domestic demand would probably yield reasonable economic rates of return. However, the export potential of these crops is much less, given that they would have to compete in foreign markets and thus would have to absorb the transport margins that in effect protect them from imports. Wheat is not a very efficient exportable commodity, given prevailing trade and shipping costs margins, and would require a large subsidy to be profitable. Exports of rice in small volumes might be feasible, provided foreign exchange received a premium of 25-30% and given some rebound in world prices from the mid-1980s levels.

2.10 The next section analyzes the nominal protection coefficients for wheat and rice and the following section the effective protection coefficients. Section C analyzes the effective subsidy coefficients and provides a detailed analysis of the subsidy calculations on the main agricultural inputs, which are used in subsequent chapters. The Chapter ends with some concluding remarks and observations.

A. Nominal Protection Coefficients (NPC) of output

2.11 As shown in the methodological section of Chapter 1, the ratio of the price the cultivator actually receives for his produce to what he would have received under a hypothetical situation of free trade in the output (wheat or rice) is termed the Nominal Protection Coefficient (NPC). The NPCs of wheat and rice are estimated under the hypotheses that the relevant commodity is an import substitute or an exportable, the importable and exportable hypotheses respectively. In a large country such as India, it is also desirable to estimate NPCs specific to different regions (surplus or deficit). Such estimates require different adjustments in calculating reference price of output. For example, if one is estimating the region specific NPCs of say wheat under the importable

hypothesis for surplus regions like Ludhiana in Punjab (or Karnal in Haryana), the reference price would be calculated as the cif price of imported wheat at Bombay port plus port clearance charges minus internal transport cost from Bombay to Ludhiana minus marketing costs and traders' (distribution) margins.

2.12 The assumption underlying this approach is that imported wheat competes with Ludhiana wheat at Bombay and thus sets the price (equal to cif price plus port clearance charges). The impact of this competition falls on the Ludhiana farmer, for whom the reference price (to be received) is reduced by an amount equivalent to the sum of transport costs (from Ludhiana to Bombay), marketing costs and associated distribution margins.

2.13 If, however, NPCs are estimated for deficit markets, such as Bhopal in Madhya Pradesh (or Lucknow in Uttar Pradesh), the reference price for the cultivator would be whatever is lowest: cif price plus port clearance charges plus transport cost to Bhopal plus marketing costs and distribution margins; or reference price in one of the other surplus centres (say Ludhiana) plus transport cost (from Ludhiana) to Bhopal plus marketing costs and distribution margins.

2.14 The domestic producer price in equation (1) is approximated by procurement price (rather than farm harvest price) of the respective crop. This is because (a) procurement price (unlike harvest price) takes care of quality aspect and upholds the principle of "like is compared with the like"[5] and (b) it reveals, in a sense, Government's intentions of what an average farmer "should" receive.[6]

2.15 The details regarding estimation of region-specific NPCs of wheat

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[5] The procurement price of wheat (or rice) relates to the fair average quality (FAQ) of the product. The international wheat price relates to US Hard Red Winter No. 2 with ordinary protein, while that of rice relates to Thai (Milled) white 5% Broken. In this context, it may be noted that in India the predominant wheat varieties (87%) belong to the triticum aestivum family, which contains many soft and hard varieties. However, a typical Indian commercial wheat has a protein content of 10.7% compared to 11.38% in US wheat and 10.07% in Australian wheat.

[6] An alternative exercise would be to take domestic prices as those hypothetical prices that would have prevailed in absence of government intervention in the form of support/procurement operations. It is very difficult to adjudge precisely what the domestic prices would be in such a counter-factual situation, yet a rough approximation would indicate that free market producer price, particularly in the case of wheat, would be a little lower than the procurement prices. This is because the pattern of market arrivals, especially in surplus states like Punjab, Haryana, Western Uttar Pradesh, is such that within weeks immedicately after harvest markets get flooded with wheat. Given the financial resources and administrative network of private traders it might not be possible for them to cope up with such abundant supplies. Moreover, their interest also would be to let the producer price fall, contrary to the objectives of FCI to provide an effective floor to producer's price. In secondary markets of deficit state also, prices are likely to be lower, given a quicker movement of wheat from surplus to deficit states.

and rice under the importable and exportable hypotheses during the 1980s are spelt out in Annexures 1 to 4. It may be pointed out that in the case of wheat, two of the states selected are considered surplus (Punjab and Haryana), and the other two deficit (Uttar Pradesh and Madhya Pradesh).[7] Accordingly, adjustments pertaining to domestic transport costs and associated margins in the two cases for calculating reference prices are different. For Madhya Pradesh (Bhopal) and Uttar Pradesh (Lucknow) wheat is assumed to flow from Punjab (Ludhiana). Under the exportable hypothesis, only Ludhiana wheat is considered for analysis, as Punjab is the only state that has a large wheat surplus. The point of competition is assumed to be Tunis in Tunisia, which is roughly equi-distant from India and US, thus allowing a comparison between fob price US and fob price Bombay.

2.16 A similar procedure is followed in estimating the NPCs of rice under the importable and exportable hypotheses. Six rice growing states were selected - Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, PUnjab and Uttar Pradesh. Only Punjab and Andhra Pradesh are considered surplus states. Rice is assumed to flow from Punjab to Uttar Pradesh, Bihar and Madhya Pradesh; and from Andhra Pradesh to Orissa. Under the exportable hypothesis, Punjab rice is deemed to compete with Thai rice in the strait of Malacca, which is equi-distant from Bangkok and Calcutta ports so that fob price at Bangkok and at Calcutta are compared.

2.17 The resulting set of NPCs of wheat and rice are presented in Tables 2.1 and 2.2 respectively.

2.18 The weighted average NPC of wheat under the importable hypothesis is below unity for all of the seven years under consideration (1980-81 to 1986-87), averaging 0.80. It has improved from 0.72 in 1980-81 to 0.91 in 1986-87, but registered wide fluctuations in between, which primarily synchronize with the volatile behaviour of international price of wheat. Across states, the surplus areas of Punjab and Haryana have higher NPCs that those of the deficit states (like Madhya Pradesh and Uttar Pradesh), indicating a somewhat "better off" situation of surplus vis-a-vis deficit regions but also reflecting the treatment of transport costs. It must be noted that all regions (surplus or deficit) during all the years had their NPCs below unity, implying that wheat cultivators in India have been 'taxed' on the pricing front compared with imports.

2.19 This conclusion reverses, however, when wheat is viewed as an exportable commodity. The Punjab wheat cultivator, under the exportable hypothesis, seems to be "protected" with an NPC of more than unity all through, averaging 1.34. This reversal is of course because exporting of wheat implies the deduction of the transport cost up to the point of sale, whereas under the importable hypothesis the transport cost is added to the international price. Hence a subsidy would seem to be needed to export wheat.

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[7] A state is deemed deficit if its contribution to the Central Pool falls short of its withdrawal from it (for the specific crop).

Table 2.1: Nominal Protection Coefficients of Wheat

States	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Haryana	0.75	0.76	0.89	0.79	0.79	0.79	0.98	0.84
	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)	(0.14)	(0.13)	(0.13)
Madhya Pradesh	0.69	0.70	0.80	0.80	0.72	0.71	0.80	0.75
	(0.12)	(0.12)	(0.12)	(0.14)	(0.12)	(0.12)	(0.12)	(0.12)
Punjab	0.76	0.77	0.90	0.90	0.80	0.80	0.99	0.85
	(0.26)	(0.28)	(0.26)	(0.26)	(0.28)	(0.28)	(0.28)	(0.27)
Uttar Pradesh	0.70	0.71	0.82	0.81	0.73	0.73	0.88	0.77
	(0.50)	(0.47)	(0.49)	(0.48)	(0.48)	(0.46)	(0.47)	(0.48)
Exportable Hypothesis								
Punjab	1.15	1.09	1.24	1.29	1.27	1.33	1.99	..34

Notes:

1. For estimational details of NPCs, see Annexures 1 and 2.
2. Figures within parentheses are the value weights derived at international reference prices (See Annexure 5).

2.20 The weighted average NPC of rice under importable hypothesis is 0.67 for the years 1980-81 to 1986-87 (Table 2.2). It is even lower than that of wheat (0.80), indicating that rice cultivators have been more "taxed" on the pricing front that the wheat cultivators. The difference between NPCs of rice and wheat was greater during 1980-81 than in 1986-87. Both NPCs rose over time although still remaining below unity. Under the exportable hypothesis, Punjab rice cultivator seems to have acquired "protection" only during 1985-86 and 1986-87. But his average situation for 1980s remains that of being 'taxed'.

2.21 It may be pointed out here that estimation of NPCs in this excercise has been carried out at the official rate of exchange. If one allows for a premium on foreign exchange of 25 percent or so, then the net NPCs of wheat and rice (adjusted for shadow price of foreign exchange) would be even lower, indicating a greater degree of "net tax" to wheat and rice cultivators.

Table 2.2: Nominal Protection Coefficients of Rice

States	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Andhra Pradesh	0.45	0.52	0.77	0.72	0.74	0.81	0.82	0.69
	(0.23)	(0.26)	(0.28)	(0.25)	(0.21)	(0.20)	(0.19)	(0.23)
Bihar	0.43	0.51	0.72	0.68	0.69	0.75	0.77	0.65
	(0.19)	(0.15)	(0.12)	(0.14)	(0.17)	(0.16)	(0.17)	(0.16)
Madhya Pradesh	0.46	0.50	0.74	0.70	0.71	0.77	0.79	0.67
	(0.14)	(0.13)	(0.13)	(0.14)	(0.12)	(0.14)	(0.15)	(0.13)
Orissa	0.44	0.50	0.72	0.68	0.69	0.75	0.76	0.65
	(0.15)	(0.13)	(0.12)	(0.15)	(0.14)	(0.15)	(0.15)	(0.14)
Punjab	0.49	0.55	0.83	0.78	0.79	0.87	0.90	0.74
	(0.10)	(0.13)	(0.14)	(0.13)	(0.14)	(0.13)	(0.16)	(0.13)
Uttar Pradesh	0.45	0.50	0.73	0.69	0.70	0.76	0.78	0.66
	(0.19)	(0.20)	(0.21)	(0.19)	(0.22)	(0.22)	(0.21)	(0.21)
Weighted Average	0.45	0.51	0.75	0.70	0.72	0.78	0.80	0.67
Exportable Hypothesis								
Punjab	0.5	0.6	0.94	0.89	0.94	1.09	1.16	0.87

Notes:

1. For estimational details of NPCs, see Annexures 3 and 4.
2. Figures in parentheses are the value weights, where the values are estimated at international reference prices (see Annexure 6).

2.22 One must be cautious about drawing inference from NPCs, as the Government seems to be following a policy of deliberate low output prices and low input prices through subsidies.[8] Thus, a better understanding would necessitate estimation of Effective Protection Coefficients (EPCs), where tradeable inputs are evaluated at international prices, and of Effective Subsidy Coefficients (ESCs), where adjustment is made for subsidies on non-tradeable inputs.

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[8] The underlying philosophy appears to be that low output prices of wheat and rice would keep these commodities within reach of common man, and low input prices would enable small farmers also to adopt new technology.

B. Effective Protection Coefficients of Output (EPCs)

2.23 The Effective Protection Coefficient (EPC) of a product is defined as a ratio of value added at domestic prices to value added at international reference prices. As noted in chapter 1, in the national accounting framework, value added implies sales value of output minus all purchased inputs, in protection theory it has a different meaning. Value added here is derived as the difference of sales value of output and all traded (tradeable) inputs.[9]

2.24 The EPC thus adjusts the nominal protection on output for the protection on the relevant traded (tradeable) inputs. Thus, the EPC is a better measure of the degree of protection (effective incentives) then the NPC. Once again it is useful to note that the effective protection (EPC) will exceed nominal protection (NPC) to the extent that inputs have a lower (higher) NPC than the NPC on the final product. Thus, the estimation of nominal protection on traded (tradeable) inputs must precede estimation of effective protection on outputs. This requires detailed information on the input structures of relevant outputs.

2.25 The input structures of wheat and paddy (Annexures 11 and 12) have been averaged over three years, 1981-82 to 1983-84, to bring about greater stability in input-output relations. These structures reveal that the major tradeable inputs are fertilizers, seeds and farm machinery (machine labor). Although insecticides also are a tradeable input, their share in total cost is very low (about 2%).

2.26 It may be pointed out here that treatment of depreciation of durable inputs often poses a problem: whether it should be treated as a tradeable or non-tradeable cost. In this paper, depreciation on farm machinery, especially tractors, threshers etc. is treated as a tradeable input and accordingly valued at international reference price, while depreciation on farm buildings etc. is taken as non-tradeable. The NPC of fertilisers (NPK) is estimated at a national level[10] as a weighted average of NPCs of Urea (46% N), Diammonium - Phosphate (DAP, 18-46-0), and Muriate of Potash (60% K_2O), with their respective consumption levels acting as weights. Individual NPCs of N, P and K are worked out as ratios of their domestic prices that farmers pay to their international reference prices, where the latter are calculated by adding distribution costs and dealers' margins in the cif prices of N,.P and K (See Annexure

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[9] Theoretically, the protection framework requires that non-traded inputs be decomposed into their tradeable components and primary non-traded (non-tradeable) components, and different treatment be accorded to both. However, empirically such refined treatments are usually precluded by the data.

[10] Region-specific NPCs of fertilizers would require detailed information on the movement of fertilizers from ports to regions, associated transport and handling costs. A detailed break down of these costs for different regions is missing and therefore an average national figure, which the Ministry pays to pool handling agencies is used(see Annexure 13 and Gulati 1988).

13). NPCs of fertilisers so derived, remained below unity during 1980-81 to 1986-87 (average = 0.82) indicating that Indian cultivators have been net "subsidised" on this count.[11]

2.27 The NPCs of farm machinery are proxied by the NPC on tractors only. Tractors appear to be the most dominant tradeable farm machinery. Estimating protection on tractors, however, is rendered difficult as the world market in tractors is not competitive and reflects circumstances peculiar to each importing country. Also India stopped importing tractors almost a decade ago. Pakistan imports tractors in SKD conditions which provides very low cif prices and cannot be used in our study. Moreover, while international trade is primarily in tractors of 50 HP plus range, the Indian market is dominated by tractors of 30 to 35 HP.[12] Under these circumstances, fob price of tractors exported from India in 1985-86 is used to estimate NPC of tractors. Given the specifications of the exported tractors (IH-444 of 45 HP) its fob price (Rs.69280) is adjusted by deducting an average internal transport cost (from Bombay port to the farmer point in North India) of Rs.1500. To this is added a dealer's margin of Rs.3850, which gives the reference price of tractor (45 HP) in North India as Rs. 71630. The domestic retail price of this tractor as being paid by farmers is Rs. 90085. This provides NPC figure of 1.26 (= 90085/71630). If tractors are treated only as exportables, NPC would be 1.33 (=90085/(69280-1500). A cross check using the movements in the unit values of world imports of tractors vis-a-vis that of Indian domestic prices of tractors suggests that the NPC of 1.26 is reasonable. Given limitations on data front, this figure of 1.26 was used as NPC for all the years and for all farm machinery included under the cost item "machine labor".

2.28 NPCs of seeds are assumed to be equal to the NPCs of their respective outputs. Resort to this approximation is primarily because of lack of information on cif prices of seeds of wheat and rice. India did not import these seeds at a commercial scale during this period and the international market of seeds is small and imperfect. On the other hand, it sounds reasonable to expect that seed and output prices of the same commodity should exhibit a similar pattern, although this is not strictly true for some HVYs that are sterile. Thus, NPCs of output are also the NPCs of their respective seeds, which are region-specific.

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[11] For greater details on how much of fertilizer subsidy (financial) as announced in the budgets of Central Government goes to agriculture and how much to the Fertilizer Industry or their feedstock supplying agencies see Gulati, 1988a, pp. 32-34, Table 3.

[12] Fifty five percent of Indian tractor market share is captured by 30-39 HOP range, 22% by 20-29 HP range and 18% by 40-49 HP range (1984 figures), see "Role of Agricultural Equipment in Modernising Indian Agriculture and Rural Prosperity", keynote address by M. M. Metha, Indian Society of Agricutural Engineers, Silver Jubilee Convention, October 29, 1985.

2.29 Weighted average NPCs of three tradeable inputs - fertilisers, farm machinery (machine labour) and seeds, are estimated for each relevant state, the share of a particular input's value in the procurement price of output acting as relevant weight. These are estimated separately under the importable hypothesis for wheat and rice (Annexures 14 and 15).

2.30 The aggregate values of three tradeable inputs in domestic prices that go to produce one unit of output, along with their weighted NPCs specific to each region of the relevant crop, are plugged in equation (2) of chapter 1, to compute the Effective Protection Coefficients (EPCs) of wheat and rice (Tables 2.3 and 2.4 respectively).

2.31 For wheat, under the importable hypothesis, the EPCs for all the states and for all the years are below unity. The weighted average EPC for the seven year period (0.75) is not only below one but also lower than its corresponding NPC (0.80). This is because the NPC of tradeable inputs is greater than NPC of wheat, which makes the EPC of wheat lower than its NPC.

2.32 Under the exportable hypothesis, the results change dramatically and the EPC of Punjab wheat (1.71) turns out to be more than double its EPC under the importable hypotheses (0.80). The main reason underlying this result is that transport costs are deducted for exports and added in for imports and these form a singificant proportion of doemstic price of wheat. Where these costs are not so high (as a percentage of domestic price output) results under exportable hypothesis do not exhibit such significant departures from their corresponding results under importable hypothesis. Also, the NPC of wheat is greater than NPC of its tradeable inputs under the exportable hypothesis. Across states, the EPC of wheat is highest of Punjab (0.80) but still remains below unity.

2.33 The weighted average EPC of rice under importable hypothesis (0.65) is below unity, is lower than its corresponding NPC (0.67) and also lower than EPC of wheat (0.75).

2.34 It should be remarked, however, that farmers basically sell paddy while international trade is in rice. Strictly speaking, the protection coefficients being estimated are not at the farmers gate but at miller. The theoretically correct procedure would involve estimation of protection to the milling process falling in between paddy and rice, and adjust that to derive the true protection to paddy farmers. This study skips this adjustment and approximates protection on paddy (farmers) with that on rice (millers).[13]

2.35 These results have significant policy implications that are discussed in section C.

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[13] It would require another detailed study on protection to the rice milling industry before an accurate estimate could be obtained for the EPC of paddy.

Table 2.3: Effective Protection Coefficients of Wheat

State	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Haryana	0.70	0.70	0.84	0.85	0.75	0.75	0.96	0.79
	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)	(0.14)	(0.13)	(0.13)
Madhya Pradesh	0.67	0.68	0.78	0.78	0.71	0.70	0.78	0.73
	(0.12)	(0.12)	(0.12)	(0.14)	(0.12)	(0.12)	(0.12)	(0.12)
Punjab	0.70	0.71	0.84	0.86	0.76	0.76	0.97	0.80
	(0.26)	(0.28)	(0.26)	(0.26)	(0.28)	(0.28)	(0.28)	(0.27)
Uttar Pradesh	0.65	0.66	0.77	0.77	0.69	0.70	0.85	0.73
	(0.50)	(0.47)	(0.49)	(0.48)	(0.48)	(0.46)	(0.47)	(0.48)
Weighted Average	0.67	0.68	0.80	0.80	0.72	0.72	0.89	0.75
Exportable Hypothesis								
Punjab	1.29	1.16	1.35	1.47	1.55	1.71	3.44	1.71

Notes: Figures in parentheses are the value weights derived at international reference prices.

C. Effective Subsidy Coefficients of Output

2.36 The estimation of ESCs of wheat and rice involves adjusting their EPCs for subsidies and taxes on their respective non-tradeable inputs, namely adding on the effective subsidy per unit to the domestic EPC. (See equation 3, Chapter 1).

2.37 In India, farmers receive subsidies on non-tradeable inputs such as water, electricity and credit, while taxes paid on non-tradeable inputs such as land etc. are almost non-existent (less than 1%, see Annexures 11 and 12). Thus, it is primarily subsidies on water, electricity and credit that are added into the numerator of the EPC to derive the ESC. It may be remarked that subsidies on fertilizers are not included separately in the estimation of ESCs because fertilizer is a tradeable input and the subsidy has already been taken into account in calculating the EPCs.

Table 2.4: Effective Protection Coefficients of Rice

State	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Andhra Pradesh	0.42	0.49	0.74	0.69	0.73	0.81	0.80	0.66
	(0.23)	(0.26)	(0.28)	(0.25)	(0.21)	(0.20)	(0.19)	(0.23)
Bihar	0.44	0.50	0.71	0.67	0.68	0.75	0.76	0.64
	(0.19)	(0.15)	(0.12)	(0.14)	(0.17)	(0.16)	(0.17)	(0.16)
Madhya Pradesh	0.45	0.46	0.73	0.69	0.71	0.77	0.78	0.65
	(0.14)	(0.13)	(0.13)	(0.14)	(0.12)	(0.14)	(0.12)	(0.13)
Orissa	0.43	0.49	0.71	0.67	0.68	0.75	0.74	0.63
	(0.15)	(0.13)	(0.12)	(0.15)	(0.14)	(0.15)	(0.15)	(0.14)
Punjab	0.46	0.51	0.80	0.75	0.77	0.87	0.88	0.72
	(0.10)	(0.13)	(0.14)	(0.13)	(0.14)	(0.13)	(0.16)	(0.13)
Uttar Pradesh	0.43	0.48	0.71	0.67	0.69	0.75	0.77	0.64
	(0.19)	(0.20)	(0.21)	(0.19)	(0.22)	(0.22)	(0.21)	(0.21)
Weighted Average	0.43	0.48	0.73	0.68	0.70	0.78	0.78	0.65
Exportable Hypothesis								
Punjab	0.47	0.57	0.93	0.88	0.95	1.13	1.19	0.87

Note: Figures in parenthesis are the value weights where the values are estimated at international reference prices.

2.38 Irrigation and electricity subsidies are broadly defined and measured as the difference between their respective annualised resource costs and revenue receipts. The credit subsidy is estimated as the difference between interest rate being charged from agriculture vis-a-vis retail trade, and an adjustment for the defaults in agriculture.[14]

2.39 More precisely, the estimation of the irrigation subsidy was carried out as follows:

Irrigation Subsidy = operational and maintenance expense plus 10%[15] charge on capital investment per hectare of canal irrigated area through major and medium irrigation schemes minus gross receipts of these schemes from agriculture.

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[14] For greater details on numerous problems encountered and resolved in appropriately defining the very concepts of these subsidies and empirically estimating these at state levels first, and then allocating these across different crops in each state, see (i) Ashok Gulati (1988a): Input Subsidies in Indian Agriculture - A Statewise Analysis (Mimeo) and (ii) Ashok Gulati (1988b): Crop Specific Allocation of Input Subsidies - A Methodological Note (Mimeo).

2.40 This adjustment renders irrigation subsidy per hectare of canal area irrigated through major and medium irrigation schemes. But our objective is to derive irrigation subsidy per unit of output (i.e. per quintal of wheat or rice). This necessitates further adjustments involving certain other approximations. Since irrigation water requirements of different crops in different regions differ significantly, irrigation subsidies even on canal irrigated area for different crops should not be treated as equal. They need to be adjusted by their relative "water weights", where the latter are derived as ratios of their respective irrigation water requirements on total irrigated area of different crops.[16] This adjustment enables one to obtain crop-specific irrigation subsidy (per hectare), but only on their canal irrigated area. All area under a particular crop, however, is not canal irrigated. There are other sources of irrigation, as well as unirrigated area under the crop. The task would have been much easier if there were published data on source-wise irrigated area under different crops. But this information is unavailable and instead what is available is sourcewise irrigated area under all crops together and not specific to each crop. Under such circumstances, it is assumed that the sourcewise break-up of irrigated area under any particular crop is the same as that under all crops together.[17] This is further adjusted by the ratio of irrigated area under the crop (irrespective of source) to total area of the crop. This provides the ratio of canal irrigated area to total area (irrigated plus unirrigated) under the crop. It is this ratio which is multiplied by the irrigation subsidy per hectare of canal irrigated area under that specific crop to obtain the irrigation subsidy per hectare of the crop. Dividing it by the yield of the crop, one gets the final result of irrigation subsidy per quintal of that crop (wheat or rice). This exercise is repeated for each relevant state, for each year (1980-81 to 1986-87) and for different crops. Results pertaining to irrigation subsidy (so derived on per quintal basis) on wheat and rice appear in Tables 2.5 and 2.6 respectively.

2.41 The electricity subsidy is calculated as follows: first electricity consumption of the different crops is estimated (on per hectare of electric tubewell irrigated area basis) by multiplying the irrigation water requirements of the different crops (m.ha) by 7.5 KWH, which is the technical specification of energy consumption of a 5 HP pump to lift 1 cm, ha. water. Next, it is multiplied by the subsidy per unit of electricity, where the latter is calculated by taking difference

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[15] This 10% consists of interest (opportunity) cost at the rate of 8.44% (which is the redemption yield on long term Government bonds maturing in 2015) and 1.56% on account of depreciation charges.

[16] See Gulati (1988) where this exercise is carried out in detail taking Punjab as an example.

[17] This assumption brings in some margin of error in our final estimates, which presumably can be reduced to some extent if these numbers are constructed at district level first. This exercise, however, is not undertaken in this study due to constraints of time and resources.

between average cost of operation (generation plus distribution) of State Electricity Boards (Rs/KWH) and the revenue received from agriculture (Rs/KWH) by the Board. This renders the electricity subsidy on per hectare basis (crop-specific) on electric tubewell irrigated area. But all area under a crop is not irrigated through electric tubewells. There are other sources of irrigation as well, and much of the cropped area is unirrigated. This entails further adjustments before the final estimates are obtained. The ratio of tubewell irrigated area to net irrigated area of the state from all sources, under all crops combined, is assumed to be the same as for each specific crop (due to lack of crop-specific information). This ratio is multiplied by the ratio of irrigated area under a crop to its total area, which provides us a ratio of tubewell irrigated area to total area (irrigated plus unirrigated) of the crop in

Table 2.5: Subsidies on Non-Tradeable Inputs of Wheat

State	Input	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Haryana	IS	21.87	24.08	24.75	27.49	29.14	26.84	32.18
	ES	1.35	1.76	1.55	1.69	2.18	2.28	2.46
	CS	1.53	2.18	2.46	2.88	3.09	3.15	3.15 *
	TS	24.75	28.02	28.76	32.06	34.41	32.27	37.79
Madhya Pradesh	IS	29.12	29.52	30.55	30.23	34.75	36.06	37.78
	ES	0.53	0.85	1.14	1.15	1.30	1.41	1.38
	CS	2.23	2.89	3.19	3.05	4.07	4.16	4.16 *
	TS	31.88	33.26	34.88	34.43	40.12	41.63	43.32
Punjab	IS	11.16	11.43	12.26	13.43	13.54	13.85	15.37
	ES	1.01	1.00	1.23	1.33	1.63	1.90	2.18
	CS	1.85	2.17	2.41	3.34	2.96	2.94	2.94 *
	TS	14.02	14.60	15.90	18.10	18.13	18.69	20.49
Uttar Pradesh	IS	20.53	22.78	22.38	23.98	26.70	27.57	31.22
	ES	0.94	0.97	0.94	0.97	1.13	1.09	1.08
	CS	1.19	1.79	1.93	2.16	2.45	2.51	2.51 *
	TS	22.66	25.54	25.25	27.11	30.28	31.17	34.81

* Credit subsidy for 1986-87 is taken as same as that for 1985-86 due to lack of required information.
Note: IS = Irrigation Subsidy, ES = Electricity Subsidy, CS = Credit Subsidy and TS = Total Subsidy.

the crop in the relevant state. But all tubewells are not electric tubewells, there are diesel ones also. Thus, this ratio is further multiplied by the ratio of electric pumps to total pumpsets in the state. The resulting ratio in turn is multiplied by the electricity subsidy per hectare of electric tubewell irrigated area (crop-specific) and then divided by yields of the respective crops. The final result is the electricity subsidy (crop-specific) on a per quintal basis for different years and states. (Tables 2.5 and 2.6).

Table 2.6: Subsidies on Non-tradeable Inputs of Rice

State	Input Subsidy	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Andhra Pradesh	IS	53.75	51.25	50.41	50.77	54.72	49.41	55.96
	ES	0.71	0.90	1.20	1.59	1.73	1.54	2.10
	CS	3.19	3.35	4.07	4.22	5.57	6.47	6.47 *
	TS	57.65	55.50	55.68	56.58	62.08	57.42	64.53
Bihar	IS	42.73	58.63	73.51	53.08	52.84	54.99	59.47
	ES	1.95	3.08	5.02	3.85	4.40	4.21	5.05
	CS	1.19	1.89	2.00	2.24	2.56	2.83	2.83 *
	TS	45.87	63.60	80.53	59.17	59.80	62.03	67.35
Madhya Pradesh	IS	39.19	45.01	54.45	43.33	60.20	46.12	63.29
	ES	0.43	0.77	1.18	0.92	1.29	1.00	1.27
	CS	3.24	4.16	4.46	4.31	5.99	6.13	6.13 *
	TS	42.86	49.94	60.09	48.56	67.48	53.25	70.69
Orissa	IS	45.14	53.79	72.46	48.75	63.51	55.65	64.47
	ES	0.25	0.36	0.68	0.46	0.60	0.54	0.70
	CS	1.58	1.87	2.41	2.42	2.90	2.90	2.90 *
	TS	46.97	56.02	75.55	51.63	67.01	59.09	68.07
Punjab	IS	53.91	54.87	56.74	64.02	64.02	74.47	78.13
	ES	3.59	3.50	4.08	4.67	5.90	7.02	7.64
	CS	2.76	3.24	3.48	4.88	4.50	4.46	4.46 *
	TS	60.26	61.61	64.30	73.57	74.42	85.95	90.23
Uttar Pradesh	IS	43.48	46.14	49.88	48.38	51.86	49.87	59.99
	ES	0.58	0.74	1.28	1.22	1.96	2.23	2.82
	CS	1.68	2.52	2.63	2.97	3.50	3.60	3.60 *
	TS	45.74	49.40	53.79	52.57	57.32	55.70	66.41

* Credit subsidy for 1986-87 is taken as same as that for 1985-86 due to lack of required information.

Note: IS = Irrigation Subsidy, CS = Credit Subsidy, ES = Electricity Subsidy and TS = Total Subsidy.

2.42 In the case of wheat, however, one also needs to add into the above results the electricity subsidy due to threshing operations carried out through electrically operated threshers. The technical specifications provide that a thresher with 9" head operating on 5 HP electric motor clears approximately two quintals of wheat per hour and consumes 3.75 KWH of electricity. But all threshing is not done through electric motors, there are diesel motors as well. It is assumed that the ratio between electricity operated threshers and diesel operated threshers is the same

as that between electric and diesel tubewells. Multiplying this ratio by 3.75/2 KWH, one gets electricity consumption per quintal of wheat, which is further multiplied by subsidy on per unit of electricity (Rs/KWH) to get electricity subsidy per unit of wheat (Rs/q) due to threshing operations. This is added into the electricity subsidy derived earlier on irrigation operations to get the total electricity subsidy per quintal of wheat for different years in the relevant states.

2.43 The credit subsidy is deemed to be composed of two components: the (a) the interest subsidy that accrues to cultivators due to the concessional rate of interest that is charged from agricultural sector vis-a-vis some other sector of the economy, say retail trade, (which comes to about 4.5% p.a.); (b) the default subsidy which accrues to agriculture in the form of bad debts that will never be paid back to the lending institutions. While the interest subsidy is estimated at 4.5%, the default subsidy is calculated by taking 40% of loans having a default history of more than 3 years as bad debts (see Gulati, 1988a for greater details). This provides the total credit subsidy at state level. Since information on institutional credit specific to each crop does not exist, one has to work with certain assumptions for allocating credit subsidy across different crops. One approach would be to assume that it is equally distributed (on per hectare of gross cultivated area basis) across all crops. The other way, presumably better, would be to assume that it is allocated across different crops according to the relative share of that crop's value productivity to the aggregate value productivity of all crops. This would imply that credit is distributed equally not on per hectare basis but per rupee of value added in agriculture through all crops. If a particular crop contributes more per unit of its output, as high value crops do, then its share in credit subsidy would be accordingly higher (See Gulati, 1988a for more details).

2.44 The subsidies on the three non-tradeable inputs - irrigation, electricity and credit, so allocated across wheat and rice in the different relevant states over the period 1980-81 to 1986-87, on per quintal basis, appear in Tables 2.5 and 2.6. The irrigation subsidy turns out to be much more important than the subsidies on electricity or credit, representing 75% to 90% of per unit subsidies.

2.45 Looking at the state data, in the case of wheat, the highest amount of subsidy accrues to Madhya Pradesh primarily due to irrigation. Punjab, on the other hand, happens to be at the lower end of the scale. The underlying reason seems to be relatively much lower capital cost involved in irrigating one hectare of land through major and medium schemes in the Punjab than in MP. However, such a result does not occur in case of rice because water requirements of rice in Punjab are much higher than in other states and since we have used "water weights" in allocating irrigation subsidy across crops, the irrigation subsidy for rice in Punjab is much higher than in the case of wheat. Thus, Punjab tops the rice states in having highest total subsidy per quintal of rice.

2.46 The impact of all these subsidies on incentive structures of wheat and rice, is captured once these are added in the numerator of the EPC to derive the ESC. ESCs of wheat (Table 2.7) under the importable and exportable hypotheses turn out to be significantly higher than either EPCs

Table 2.7: Effective Subsidy Coefficients of Wheat

States	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Haryana	0.90	0.92	1.08	1.10	0.99	0.97	1.27	1.03
	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)	(0.14)	(0.13)	(0.13)
Madhya Pradesh	0.90	0.89	1.01	1.00	0.94	0.93	1.04	0.96
	(0.12)	(0.12)	(0.12)	(0.14)	(0.12)	(0.12)	(0.12)	(0.12)
Punjab	0.82	0.82	0.98	1.01	0.88	0.89	1.15	0.93
	(0.16)	(0.28)	(0.26)	(0.26)	(0.28)	(0.29)	(0.28)	(0.27)
Uttar Pradesh	0.82	0.83	0.95	0.95	0.88	0.88	1.09	0.91
	(0.50)	(0.47)	(0.49)	(0.48)	(0.48)	(0.46)	(0.47)	(0.48)
Weighted Average	0.76	0.85	0.99	0.99	0.90	0.90	1.12	0.93
Exportable Hypothesis	1.57	1.35	1.57	1.73	1.81	2.00	4.07	2.01

Note: Figures in parentheses are the value weights, where the values are estimated at international reference prices.

or NPCs. The weighted average ESC of wheat under importable hypothesis, is 0.93 for the period 1980-81 to 1986-87, compared to an NPC of 0.80 and EPC of 0.75. On average the estimated subsidies on non traded inputs on wheat thus represented 24% of value added (including non traded inputs).[18] In 1986-87, due to a sharp dip in the international price of wheat, wheat received positive protection. Under the exportable hypothesis, wheat cultivators of Punjab had positive protection all years, which increased tremendously in 1986-87.

2.47 Across the states, the adjustment for subsidies suggests the Haryana wheat cultivator is somewhat protected (ESC = 1.02) compared to wheat cultivators in other states for whom the ESC still remains below unity.

2.48 The weighted average ESC of rice under importable hypothesis is 0.87 (average of 1980-81 to 1986-87), which is much higher than the NPC (0.67) and EPC (0.65). Thus, the estimated subsidies on non traded inputs represented almost 34% of value added including non-traded inputs.

2.49 The ESC on rice is lower than the ESC of wheat (0.93). Punjab

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[18] The proportionate subsidy can be derived by noting that ESC = EPC + (Subsidy/VA^R).

Table 2.8: Effective Subsidy Coefficients of Rice

States	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Andhra Pradesh	0.59	0.66	0.98	0.91	0.96	1.04	1.05	0.88
	(0.23)	(0.26)	(0.28)	(0.25)	(0.21)	(0.20)	(0.19)	(0.23)
Bihar	0.57	0.69	1.03	0.88	0.89	0.96	1.00	0.86
	(0.19)	(0.15)	(0.12)	(0.14)	(0.17)	(0.16)	(0.17)	(0.16)
Madhya Pradesh	0.58	0.59	0.97	0.86	0.93	0.95	1.04	0.85
	(0.14)	(0.13)	(0.13)	(0.14)	(0.12)	(0.14)	(0.12)	(0.13)
Orissa	0.56	0.65	1.00	0.84	0.90	0.95	0.98	0.84
	(0.15)	(0.13)	(0.12)	(0.15)	(0.14)	(0.15)	(0.15)	(0.14)
Punjab	0.64	0.71	1.10	1.05	1.07	1.23	1.26	1.01
	(0.10)	(0.13)	(0.14)	(0.13)	(0.14)	(0.13)	(0.16)	(0.13)
Uttar Pradesh	0.57	0.63	0.93	0.86	1.02	0.96	1.02	0.85
	(0.19)	(0.20)	(0.21)	(0.19)	(0.22)	(0.22)	(0.21)	(0.21)
Weighted Average	0.58	0.65	0.99	0.90	0.96	1.01	1.06	0.88
Exportable Hypothesis								
Punjab	0.65	0.77	1.26	1.21	1.30	1.60	1.68	1.21

Note: Figures in parentheses are the value weights, where the values are estimated at international references prices.

rice under both the importable and exportable hypotheses, appears to receive positive protection, which was quite high in 1986-87 (ESC = 1.26 and 1.68 under the two hypotheses, respectively). The protection of Punjab rice clearly reflects the high irrigation subsidy.

2.50 In the case of the other states the ESC of rice remains below the ESC of wheat; in the case of Punjab this ordering reverses. Rice cultivators of the Punjab (and presumably of Haryana too) are not only more protected than the rice cultivators in other states but also more protected compared to wheat cultivators in the Punjab itself. However, the ESC of Punjab rice under exportable hypothesis (1.21) although greater than unity, is significantly lower than ESC of wheat (2.01). Again this reflects lower the share of transport costs (domestic and international)

and other marketing margins in the international price of rice, than in case of wheat. Since the adjustments pertaining to transport costs and margins required under exportable hypothesis are different than those under importable hypothesis, protection coefficients of wheat under the exportable hypothesis and importable hypothesis exhibit a greater degree of variation than that of rice.

D. Concluding Observations and Future Outlook:

2.51 What do the estimated results of NPCs, EPCs and ESCs reveal? What signals do they provide for agricultural price policy, trade policy and investment programmes within agriculture, so that resources can be allocated more efficiently in an effort to achieve a rational/desirable cropping pattern?

2.52 The results suggest that wheat and rice cultivators, on an average, have experienced disprotection, (net "taxation"), on the pricing front during 1980s, compared to what would have prevailed under free trade. This is despite large subsidies on various inputs. Under the importable hypothesis, it may be recalled that the estimates of the weighted average NPCs, EPCs and ESCs for both wheat and rice, were all below unity for the (average) seven year period of 1980s (1980-81 to 1986-87) (Table 2.9). The degree of net "taxation" (measured by the inverse of ESCs) has been higher for rice cultivators (ESC = 0.87) than for wheat cultivators (ESC = 0.93). Reflecting the large estimated subsidy on irrigation, Haryana in the case of wheat (ESC = 1.02) and Punjab in the case of rice (ESC = 1.00) remained free from net "taxation". These results reflect the large estimated subsidy on irrigation. These results also suggest that Indian agricultural price policy has had some "bias", not only in favour of wheat vis-a-vis rice, but also in favour of norther states of Punjab and Haryana.[20]

2.53 Effective incentives (ESCs) in both wheat and rice improved during 1980s (i.e. they moved closer to international levels). However, domestic agricultural price and subsidy policy with respect to these crops played little if any role in the improvement, which mainly reflected a sharp decline in the international prices of the commodities, especially during 1986 and 1987 see Table 1.10). The international price of rice in 1987, at 1985 constant dollars, e.g., was less than half of what it was in 1980s. The improvement has been faster in case of rice, with the ESC having gone up from 0.57 in 1980-81 to 1.04 in 1986-87, than in case of wheat, where ESC moved up from 0.75 to 1.12. Similarly, wheat price had declined by about 44% over this period (Table 2.10).

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[20] It may be noted that a similar conclusion was drawn by Ashok Mitra although though an entirely different approach of analysis (see Ashok Mitra, Terms of Trade and Class Relations : An Essay in Political Economy, Frank Cass, London, 1977).

Table 2.9: Regional Dispersion of Effective Incentives for Wheat & Rice Cultivators in India (Average 1980-81 to 1986-87)

Crop/Hypothesis/States	NPCs	EPCs	ESCs	Index of ESCs (Weighted Average = 100)
Wheat (Importable Hypothesis)				
Haryana	0.84	0.79	1.03	110.75
Madhya Pradesh	0.75	0.73	0.96	103.22
Punjab	0.85	0.80	0.93	100.00
Uttar Pradesh	0.77	0.73	0.91	97.85
Weighted Average	0.80	0.75	0.93	100.00
Wheat (Exportable Hypothesis)				
Punjab	1.34	1.71	2.01	.
Rice (Importable Hypothesis)				
Andhra Pradesh	0.69	0.66	0.88	100.00
Bihar	0.65	0.64	0.86	97.72
Madhya Pradesh	0.67	0.65	0.85	96.59
Orissa	0.65	0.63	0.84	95.45
Punjab	0.74	0.72	1.01	114.77
Uttar Pradesh	0.66	0.64	0.85	96.59
Weighted Average	0.67	0.65	0.88	100.00
Rice (Exportable Hypothesis)				
Punjab	0.87	0.87	1.21	

2.54 Short term projections by the World Bank indicate that these commodity prices are likely to remain at their present levels, at least up to 1990, and that even by 2000 they will not recover to their 1980 levels. This would, imply, therefore, that as the years unfold Indian wheat and rice cultivators would retain the level of effective incentives achieved during 1986-87, and might even become more protected if domestic prices of these commodities are raised and exchange rate does not depreciate significantly.

Table 2.10: Temporal Behaviour of Protection Coefficients of Wheat and Rice (Weighted Average)

Crop/Hypothesis/Protection Coefficient		1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Wheat (Importable Hypothesis)									
	NPCs	0.72	0.73	0.84	0.84	0.76	0.76	0.91	0.80
	EPCs	0.67	0.68	0.80	0.80	0.72	0.72	0.89	0.75
	ESCs	0.76	0.85	0.99	0.99	0.90	0.90	1.12	0.93
Wheat (Exportable Hypothesis)									
	NPCs	1.15	1.09	1.24	1.29	1.27	1.33	1.99	1.34
	EPCs	1.29	1.16	1.35	1.47	1.55	1.71	3.44	1.71
	ESCs	1.57	1.35	1.57	1.73	1.81	2.00	4.07	2.01
Rice (Importable Hypothesis)									
	NPCs	0.45	0.51	0.75	0.70	0.72	0.78	0.80	0.67
	EPCs	0.43	0.48	0.73	0.68	0.70	0.78	0.78	0.65
	ESCs	0.58	0.65	0.99	0.90	0.96	1.01	1.06	0.88
Rice (Exportable Hypothesis)									
	NPCs	0.50	0.60	0.94	0.89	0.94	1.09	1.16	0.87
	EPCs	0.47	0.57	0.93	0.88	0.95	1.13	1.19	0.87
	ESCs	0.65	0.77	1.26	1.21	1.30	1.60	1.68	1.21

									Short Run Projections			Long Run	
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1995	2000
International Price of Wheat 1 (Constant $/MT)	183	187	161	168	167	173	136	102	109	115	108	133	138
International Price of Rice 2 (Constant $/MT)	416	461	284	275	255	216	178	176	185	170	171	209	213

Notes: 1: International price is at 1985 constant dollars. For wheat variety covered is Canadian No. 1 Western Red Spring 13.5%, basis in store Thunder Bay, domestic: from April 1985, St. Lawrence export.

2: Rice prices are also at 1985 constant dollars. Variety covered is Thai white, milled 5% broken, government standard, export price, FOB Bangkok.

Source: Half Yearly Revision of Commodity Price Forecasts - Jan. 1988, International Commodity Markets Division International Economics Department, The World Bank.

2.55 It may be recalled here that the above results hold only when wheat and rice are viewed as importables and estimates of protection coefficients are derived at official exchange rate. If, however, one attaches a premium of say 25% on foreign exchange to allow for over-valuation of exchange rate, and reworks the protection coefficients, the ESCs so derived would turn out to be very close to cost benefit indicators such as Domestic Resource Cost (DRC). The "adjusted" ESCs (adjusted for exchange rate) would be more depressed than the estimates derived above. These new results would indicate that wheat and rice are efficient import substitutes, and ceteris paribus are likely to remain so in the coming years. This would imply that the economic rate of return (ERR) on investment programmes promoting production of these commodities would be high, so long they are import substitutes. ERR would be higher in case of rice than in the case of wheat. Within rice, it would be highest in backward states like Orissa, Madhya Pradesh, Bihar and eastern Uttar Pradesh and lowest in Punjab (Haryana). The implications of these results are very clear : rice may be promoted in high rainfall areas of eastern India and less so in the north western belt. In this context, the Special Rice Programme launched by Government of India in the eastern states since 1984-85 deserves special mention as this would have much higher ERR than rice programmes anywhere else.

2.56 At this juncture, the desirability of rice cultivation in Punjab-Haryana belt invites a comment. It may be noted that Punjab-Haryana belt is primarily a low rainfall region. Since rice is a water intensive crop, irrigation requirements are very high (about 164 cms/ha). Not only is there is a sizeable subsidy on canal irrigation in these areas; electric tubewells are also subsidized heavily. The marginal cost of a new plant supplying electricity to agricultural sector is quite high, perhaps as much as Rs. 1.50 per KWH. Given the acute shortage of electricity, especially during peak seasons, it might be realistic to attach a premium to electricity process and take its shadow price at about Rs. 2 per KWH. On an electric tubewell (5 HP) irrigated paddy field, it would consume about 1230 KWH of electricity per hectare to draw 164 cms of water. This amounts to a subsidy of around Rs.2337 per hectare (as the revenue receipt from agriculture in Punjab in 1986-87 was about Rs.0.1/KWH. Thus, 1230 x 1.90 = 2337). Dividing it by an average yield of even 50 quintals, the electricity subsidy on per quintal of electric tubewell irrigated rice would turn out to be Rs.47, raising the ESC substantially and indicating a very low ERR for tubewell rice.[21]

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[21] This is a very rough calculation to provide a feel of the magnitudes involved. It does not take into account the need for vertical pumping out the water in water logged areas of Punjab that might arise if rice is cultivated. The much lower subsidy shown in table 2.6 reflects a) an average subsidy per kwh of Rs. 0.4 and the averaging of the total subsidy across all rice production.

2.57 Under the exportable hypothesis, the protection coefficients of wheat (NPCs, EPCs and ESCs) were above one for the 1980s (average 1980-81 to 1986-87). The ESC of wheat, for example, was 2.01, although in 1986-87 it had touched even 4.07. The ESC of rice, on the other hand, though greater than unity, was significantly lower (1.21). These results, therefore, suggest that wheat, and to a lesser extent rice are not efficient exportable commodities, the more so since 1986-87. A direct implication of this for the policy maker allocating resources would be to expand production of rice and wheat to the point they are import substitutes and thereafter keep a rate of growth that equals their demand profiles. Investment programs to produce wheat for exports do not appear to be economically attractive propositions. Rice exports would be efficient provided a premium of 20-25% were given to foreign exchange earnings, international prices were to rebound and expansion takes place in the high rainfall areas.

Annexure 11 Estimation of NPCs of Wheat (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price (fob, US gulf) April-June	US $/MT	162.33	174.67	161.33	158.67	154.00	139.33	115.67
2. Freight	$/MT	53.86	46.42	29.54	30.00	30.00	30.00	25.33
3. Exchange Rate (April-June)	1$=Rs	7.84	8.48	9.40	10.01	11.03	12.44	12.51
4. Price (C & F) = (1+2)x(3)/10	Rs/q	169.49	187.48	179.42	188.86	202.95	210.65	176.39
5. Port clearance charges	Rs/q	5.00e	5.00e	7.44	10.18	18.44	20.00e	25.00e
6. Landed cost at port (4+5)	Rs/q	174.49	192.48	186.86	199.04	221.39	230.65	201.39
7. Marketing costs and traders' margin @ 6% of procurement price (excluding domestic transport cost)	Rs/q	7.02	7.80	8.52	9.06	9.12	9.42	9.72
8. Reference price for surplus States (excluding domestic transport cost (6-7)	Rs/q	167.47	184.68	178.34	189.98	212.27	221.23	191.67
9. All India Procurement price of wheat	Rs/q	117.00	130.00	142.00	151.00	152.00	157.00	162.00
10 Haryana (Karnal)								
10. Transport cost from Bombay to Karnal (1675 kms)	Rs/q	12.23	14.57	19.09	20.27	20.27	23.45	25.96
11. Reference price for Haryana (8-10)	Rs/q	155.24	170.11	159.25	169.71	192.00	197.78	165.71
12 NPC of wheat (9/11)		0.75	0.76	0.89	0.89	0.79	0.79	0.98
Madhya Pradesh (Bhopal)								
13 Transport cost from Ludhiana to Bhopal (1050 kms)	Rs/q	7.66	9.13	11.97	12.70	12.70	14.70	16.27
14 Reference price for MP (17+13+7)	Rs/q	168.65	185.52	177.74	189.36	211.71	219.45	201.39
15 NPC of wheat (9/14)		0.69	0.70	0.80	0.80	0.72	0.71	0.80
Punjab (Ludhiana)								
16 Transport cost from Bombay to Ludhiana (1850 kms)	Rs/q	13.50	16.09	21.09	22.38	22.38	25.90	28.67
17 Reference price for Punjab (8-16)	Rs/q	153.97	168.59	157.25	167.60	189.89	195.33	163.00
18 MT wheat (9/17)		0.76	0.77	0.90	0.90	0.80	0.80	0.99
Uttar Pradesh (Lucknow)								
19 Transport cost from Ludhiana to Lucknow (720 kms)	Rs/q	5.26	6.26	8.21	8.71	8.71	10.06	11.16
20 Reference price for UP (17+19+7)	Rs/q	166.25	182.65	173.98	185.37	202.72	214.83	183.86
21 NPC of wheat (9/20)		0.70	0.71	0.82	0.81	0.73	0.73	0.88

Notes:

1. e = estimated

1. International prices are of US Hard Winter No. 2 variety and belong to those months (April to June) that correspond with the peak marketing season of wheat in India.

2. Marketing costs and traders' margins (except transport cost) are estimated at 6% of the procurement price, which is an approximate average of five years (1980-81 to 1984-85), see Annexure 10 for details.

3. In estimating transport costs, it is assumed that 40% of wheat moves by road, and that road transportation is about 40% costlier than rail transport. Thus, the ultimate transport cost is 1.16 times the rail cost of transportation.

4. For surplus states (Punjab and Haryana) reference price is estimated by deducting from the Landed cost at port the domestic transport cost and associated marketing costs and traders' margins, whereas for deficit states, (Madhya Pradesh and Uttar Pradesh), these costs are added in the reference price of the nearest surplus state (see text for reasons).

Sources: 1. FAO Monthly Bulletin of Statistics (for Row 1)
2. FAO Trade Year Book (for Row 2)
3. RBI Bulletin (for Row 3)
4. FCI Annual Reports (for Rows 5 and 9)

ANNEXURE 2: NOMINAL PROTECTION COEFFICIENTS OF PUNJAB WHEAT (EXPORTABLE HYPOTHESIS)

	Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1	fob price at Bombay port (= fob Price at US gul) (April-June)	$/MT	162.33	174.67	161.33	158.67	154.00	139.33	115.67	
2	Exchange Rate (April-June)	1$=Rs	7.84	8.48	9.40	10.01	11.03	12.44	12.51	
3	fob price at Bombay port	Rs/q	127.27	148.12	151.65	158.83	169.86	173.33	144.70	
4.	Port clearance charges	Rs/q	5.00[e]	5.00[e]	7.44	10.18	18.44	20.00[e]	25.00[e]	
5	Transport cost from Bombay to Ludhiana	Rs/q	13.50	16.09	21.09	22.38	22.38	25.90	28.67	
6	Marketing costs & distribution margins @ 6% of procurement price	Rs/q	7.02	7.80	8.52	9.06	9.12	9.42	9.72	
7	Reference price at Ludhiana (3-4-5-6)	Rs/q	101.75	119.23	114.60	117.21	119.92	118.01	81.31	
8	Procurement Price	Rs/q	117.00	130.00	142.00	151.00	152.00	157.00	162.00	
9	NPC for Ludhiana wheat farmer		1.15	1.09	1.24	1.29	1.27	1.33	1.99	1.34

For references, see Annexure 1.

e = estimated.

Annexure 3: Estimation of NPCs of Rice (Importable Hypothesis)

	Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Ave.
1	Price for (fob Bangkok) (Oct-Jan)	US$/MT	447.50	390.25	262.25	278.25	238.00	226.75	210.75	
2	Freight	$/MT	21.54	18.56	11.82	12.00	12.00	12.00	10.13	
3	Exchange Rate (Oct-Jan)	1$=Rs	7.88	9.10	9.74	10.46	12.37	12.10	13.02	
4	Price (C & F) (Row 1 + Row 2) Row 3/10	Rs/q	369.60	372.02	266.94	303.60	308.00	288.89	287.26	
5	Port clearance charges	Rs/q	6.00*	6.00*	8.45*	11.56	15.88	20.00*	25.00*	
6	Landed cost at port (Row 5 + Row 6)	Rs/q	375.60	378.02	275.39	315.16	323.88	308.89	312.26	
	Andhra Pradesh (Vijaywada)									
7	Procurement Price	Rs/q	165.50	190.50	201.55	217.30	227.40	235.30	241.60	
8	Marketing costs and distribution margins (@ 5% of procurement price)	Rs/q	9.27	9.52	10.08	10.86	11.37	11.76	12.08	
9	Transport cost from Madras port to Vijaywada (390 kms)	Rs/q	2.85	3.39	4.45	4.72	4.72	5.46	6.04	
10	Reference price for A.P. (6-8-9)	Rs/q	364.48	365.11	260.86	299.58	307.79	291.67	294.14	
11	NPCs for Andhra Pradesh Rice farmer (7/10)		0.45	0.52	0.77	0.72	0.74	0.81	0.82	0.69
	Bihar (Patna)									
12	Procurement price	Rs/q	165.50	183.25	194.20	209.35	219.15	226.75	232.90	
13	Marketing costs and distribution on margins (0.05 x Row 12)	Rs/q	8.27	9.16	9.71	10.47	10.96	11.34	11.64	
14	Transport cost from Ludhiana to Patna (1160 kms)	Rs/q	8.47	10.09	13.22	14.04	14.04	16.24	17.98	
15	Reference price (30+13+14)	Rs/q	371.21	372.79	268.70	308.07	316.77	300.74	303.28	
16	NPCs for Bihar Rice farmer (12/15)		0.45	0.51	0.72	0.68	0.69	0.75	0.77	0.65
	Madhya Pradesh (Bhopal)									
17	Procurement price	Rs/q	169.50	187.30	198.10	213.55	223.55	231.30	237.50	
18	Marketing costs and distribution margins	Rs/q	8.47	9.36	9.90	10.68	11.18	11.56	11.87	
19	Transport cost from Ludhiana to Bhopal (1050 kms)	Rs/q	7.66	9.14	11.97	12.70	12.70	14.70	16.27	
20	Reference price (30+19+19)		370.60	372.04	267.64	306.94	315.65	299.42	301.80	
21	NPCs for Madhya Pradesh Rice farmer (17/20)		0.46	0.50	0.74	0.70	0.71	0.77	0.79	0.67
	Orissa (Bhubneshwar)									
22	Procurement Price	Rs/q	166.50	191.25	202.30	219.15	228.30	237.80	244.20	
23	Marketing costs and distribution margins	Rs/q	8.32	9.56	10.11	10.91	11.41	11.89	12.21	
24	Transport cost from Vijaywada to Bhubneshwar (870 kms)	Rs/q	6.35	7.57	9.92	10.53	10.53	12.18	13.48	
25	Reference price (10+23+24)	Rs/q	379.15	382.24	280.99	321.02	329.73	315.74	319.83	
26	NPCs for Orissa Rice farmer (22/25)		0.44	0.50	0.72	0.68	0.69	0.75	0.76	0.65
	Punjab (Ludhiana)									
27	Procurement price	Rs/q	174.50	193.80	204.85	220.65	230.75	238.70	245.00	
28	Marketing costs and distribution margins	Rs/q	8.72	9.69	10.24	11.03	11.54	11.93	12.25	
29	Transport cost from Calcutta port to Ludhiana (1700 kms)	Rs/q	12.41	14.79	19.38	20.57	20.57	23.80	26.35	
30	Reference price (6-28-29)	Rs/q	354.47	353.54	245.77	283.56	291.77	273.16	273.66	
31	NPCs for Punjab (27/30)		0.49	0.55	0.83	0.78	0.79	0.87	0.90	0.74
	Uttar Pradesh (Lucknow)									
32	Procurement price	Rs/q	164.50	182.80	193.20	208.05	217.65	225.10	231.05	
33	Marketing costs and distribution margins	Rs/q	8.22	9.14	9.66	10.40	10.88	11.25	11.55	
34	Transport cost from Ludhiana to Lucknow (720 kms)	Rs/q	5.26	6.26	8.21	8.71	8.71	10.08	11.16	
35	Reference price (30+33+34)	Rs/q	367.95	368.94	263.64	302.67	311.36	294.49	296.37	
36	NPCs for Uttar Pradesh (32/35)		0.45	0.50	0.73	0.69	0.70	0.76	0.78	0.66

Notes:

1. e = estimated

1. International prices are of Thai (milled) White 5% broken variety and belong to those months (October to January) that correspond with the peak marketing season of rice in India.

2. Marketing costs and traders' margins (except transport cost) are estimated at 5% of the procurement price, which is an approximate average of 5 years (1980-81 to 1984-85), see Annexure 10 for details.

3. Same as footnote 3 in Annexure 1.

4. Punjab and Andhra Pradesh are taken as surplus states and their reference price is estimated by deducting from the landed cost at port the domestic transport cost and associated marketing costs and traders' margins. On the other hand, Bihar, Madhya Pradesh, Orissa and Uttar Pradesh are treated as deficit states in rice. Rice is assumed to flow from Punjab to Bihar, Madhya Pradesh and Uttar Pradesh while in case of Orissa it flows from Andhra Pradesh. The reference prices of rice for deficit states, therefore, are worked out by adding transport costs and associated margins in the reference price of the surplus state from where rice flows to the relevant deficit state.

Annexure 4: Nominal Protection Coefficients of Punjab Rice (Exportable Hypothesis)

	Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1	fob price at Calcutta (Oct-Jan) (= fob price at Bangkok)	$/MT	477.50	390.25	262.25	278.25	238.00	226.75	210.50
2	Exchange Rate (Oct-Jan)	1$=Rs	7.83	9.10	9.74	10.46	12.32	12.10	13.02
3	fob price at Calcutta (Oct-Jan)	Rs/q	376.27	355.13	255.43	291.05	293.22	274.37	274.07
4	Port clearance charges	Rs/q	6.00[e]	6.00[e]	8.45[e]	11.56	15.88	20.00[e]	25.00[e]
5	Transport cost from Ludhiana to Calcutta (1700 kms)	Rs/q	12.41	14.79	19.38	20.57	20.57	23.80	26.35
6	Marketing costs and distribution margins (@ 5% of procurement price)	Rs/q	8.72	9.69	10.24	11.03	11.54	11.93	12.25
7	Reference price at Ludhiana (3-4-5-6)	Rs/q	349.14	324.65	217.36	247.89	245.23	218.64	210.47
8	Procurement price at Ludhiana	Rs/q	174.50	193.80	204.85	220.65	230.75	238.70	245.00
9	NPCs of Rice for Ludhiana farmer (8/7)		0.50	0.60	0.94	0.94	0.94	1.09	1.16

Note: e = estimated

For References, see Annexure 3.

Annexure 5: Estimation of Value Weights of Wheat (Importable Hypothesis)

	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Ave.
Haryana									
Production	(m.t.)	3.49	3.68	4.35	4.46	4.42	5.26	5.06	
Reference price	Rs/q	155.24	170.11	159.25	169.71	192.00	197.78	165.71	
Value	Rs 10 m.	541.79	626.01	692.74	756.91	848.64	1040.32	838.49	
Value weight		0.12	0.13	0.13	0.12	0.12	0.14	0.13	0.12
Madhya Pradesh									
Production	(m.t.)	3.14	3.31	3.80	4.37	3.94	4.13	3.87	
Reference price	Rs/q	168.65	185.52	177.74	189.86	211.71	219.45	201.39	
Value	Rs.10 m.	529.56	614.07	675.41	827.50	834.14	906.33	779.38	
Value weight		0.12	0.12	0.12	0.14	0.12	0.12	0.12	0.12
Punjab									
Production	(m.t.)	7.68	8.55	9.16	9.42	10.18	10.99	11.15	
Reference price	Rs/q	153.97	168.59	157.25	167.60	189.89	195.33	163.00	
Value	Rs.10 m.	1182.49	1441.45	1440.41	1578.79	1933.08	2146.68	1817.45	
Value weight		0.26	0.28	0.26	0.26	0.28	0.28	0.28	0.27
Uttar Pradesh									
Production	(m.t.)	13.39	12.75	15.26	16.12	15.68	16.48	16.08	
Reference price	Rs/q	166.25	182.65	173.98	185.37	207.72	214.83	183.88	
Value	Rs.10 m.	2226.09	2328.79	2654.94	2988.16	3257.05	3540.40	2956.79	
Value weight		0.50	0.47	0.49	0.48	0.48	0.46	0.47	0.48
Total value of 4 states	Rs.10m.	4479.93	5010.31	5463.49	6151.37	6872.91	7633.73	6392.11	
Agg. value weight		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Annexure 6: Estimation of Value Weights of Rice (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Andhra Pradesh								
Production	m.t.	7.01	7.87	7.67	8.79	6.91	7.61	6.74
Reference price	Rs/q	364.48	365.11	260.86	299.58	307.79	291.67	294.14
Value	Rs.10 m.	2555.00	2873.41	2000.80	2633.31	2126.83	2219.61	1982.50
Value weight		0.23	0.26	0.28	0.25	0.21	0.20	0.19
Bihar								
Production	m.t.	5.64	4.26	3.07	4.97	5.38	6.02	6.01
Reference price	Rs/q	371.21	372.79	268.70	308.07	316.77	300.74	303.28
Value	Rs.10 m.	2093.62	1588.08	824.91	1531.11	1704.22	1810.45	1822.71
Value weight		0.19	0.15	0.12	0.14	0.17	0.16	0.17
Madhya Pradesh								
Production	m.t.	4.05	3.83	3.45	4.80	3.76	5.42	4.27
Reference price	Rs/q	370.60	372.04	267.64	306.94	315.65	299.42	301.80
Value	Rs.10 m.	1500.93	1424.91	923.36	1473.31	1186.84	1622.86	1288.69
Value weight		0.14	0.13	0.13	0.14	0.12	0.14	0.12
Orissa								
Production	m.t.	4.30	3.85	2.99	5.12	4.17	5.23	4.83
Reference price	Rs/q	379.15	382.24	280.89	321.02	329.73	315.74	319.83
Value	Rs.10 m.	1630.34	1471.62	839.86	1643.62	1374.97	1651.32	1544.78
Value weight		0.15	0.1.	0.12	0.15	0.14	0.15	0.15
Punjab								
Production	m.t.	3.22	3.75	4.15	4.54	5.05	5.45	6.02
Reference price	Rs/q	354.47	353.54	245.77	283.56	291.77	273.16	273.66
Value								
Value	Rs.10 m.	1141.39	1325.77	1019.94	1287.36	1473.44	1488.72	1647.43
Value weight		0.10	0.13	0.14	0.13	0.14	0.13	0.16
Uttar Pradesh								
Production	m.t.	5.57	5.90	5.65	6.78	7.16	8.31	7.26
Reference price	Rs/q	367.95	368.94	263.44	302.67	311.36	294.49	296.37
Value	Rs.10 m.	2049.48	2176.75	1489.57	2052.10	2229.34	2447.21	2151.65
Value weight		0.19	0.20	0.21	0.19	0.22	0.22	0.21
Total of above six states								
Production	m.t.	29.79	29.46	26.98	35.00	32.43	38.04	29.11
Value	Rs.10m.	10970.76	10860.54	7098.44	10620.81	10095.64	11240.17	10437.76
Value weight		1.00	1.00	1.00	1.00	1.00	1.00	1.00

Annexure 7: Procurement Prices of Wheat (FAQ) and Rice (Common) Selected States

(Rs/quintal)

States	Marketing Years						
	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
RICE							
Andhra Pradesh	165.50	190.50	201.55	217.30	227.40	235.30	241.60
Bihar	165.50	183.25	194.20	209.35	219.15	226.75	232.80
Haryana	175.25	194.70	205.85	221.75	233.90	241.90	248.30
Madhya Pradesh	169.50	187.30	198.10	213.55	223.55	231.30	237.50
Orissa	166.50	191.25	202.30	218.15	228.30	237.80	244.20
Punjab	174.50	193.80	204.85	220.65	230.75	238.70	245.00
Uttar Pradesh	164.50	182.80	193.20	208.05	217.65	225.10	231.05
WHEAT							
Same for all States	117.00	130.00	142.00	151.00	152.00	157.00	162.00

Source: FCI Annual Reports (Various years)

ANNEXURE 8: APPROXIMATE RAIL DISTANCE

From	To	Distance (Kms)
Bombay Port (Maharashtra)	Bhopal (M.P.)	880
-do-	Lucknow (U.P.)	1375
-do-	Karnal (Haryana)	1675
-do-	Ludhiana (Punjab)	1850
Calcutta Port (West Bengal)	Bhubneshwar (Orissa)	410
-do-	Patna (Bihar)	540
-do-	Lucknow (U.P.)	980
-do-	Ludhiana (Punjab)	1700
Madras Port (Tamil Nadu)	Vijaywada (A.P.)	390
-do-	Bhopal (M.P.)	1480
Ludhiana	Bhopal	1050
Ludhiana	Lucknow	720
Ludhiana	Patna	1160
Ludhiana	Vijaywada	2070
Vijaywada	Bhubneshwar	870

ANNEXURE 9: FREIGHT RATES FOR FOODGRAINS

(Rs/MT Km)

		1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1	Railway freight (revised) for foodgrains	0.063	0.075	0.098	0.104	0.104	0.121	0.134
2	Railway & Road weighted freight rate	0.073	0.087	0.114	0.121	0.121	0.140	0.155

Notes: 1. Railway freights actually are telescopic in nature and taper-down with the increase in distance. However, in this study, they are taken as flat rates per MT Km, based on the freight revenue and total distance covered. It means these are basically weighted average (ex-post) freight rates.

2. For row-2, it is assumed that 40% of gram moves by road and that the road transportation is 40% costlier than the rail transportation. It provides rail and road weighted freight rate as 1.16 times the rail freight rate. (There is admittedly scope of further research and firming up this estimate. It is not undertaken here due to constraints of time and resources).

Source: Annual Report and Accounts, Indian Railways, Ministry of Railways, Government of India.

Annexure 10: Marketing Costs (excluding transport costs) and Distribution Margins

States	1980-81	1981-82	1982-83	1983-84	1984-85	Average
RICE						
Andhra Pradesh	9.96 (6.02)	10.71 (5.62)	11.05 (5.48)	11.52 (5.30)	12.82 (5.64)	5.61
Bihar	9.96 (6.02)	10.50 (5.73)	10.83 (5.58)	11.28 (5.39)	11.57 (5.28)	5.60
Madhya Pradesh	10.08 (5.95)	10.62 (5.67)	10.94 (5.52)	11.40 (5.34)	11.71 (5.24)	5.54
Orissa	10.00 (6.00)	10.74 (5.62)	11.07 (5.47)	11.54 (5.29)	11.85 (5.19)	5.51
Punjab	11.23 (6.43)	11.81 (6.09)	11.15 (5.44)	11.62 (5.27)	12.92 (5.60)	5.77
Uttar Pradesh	9.93 (6.04)	10.48 (5.73)	10.80 (5.59)	11.24 (5.40)	11.53 (5.30)	5.61
WHEAT						
Same as for all States	8.51 (7.27)	8.90 (6.85)	9.26 (6.52)	9.53 (6.31)	9.56 (6.29)	6.65

Notes:

1. Marketing costs and distribution margins consist of interest cost, handling expenses, storage charges, establishment charges, distribution margin of the wholesaler and miscellaneous expenses arising out of transit and storage losses. Although these components differ from state to state and season to season for wheat and rice, no firm estimates are available for different regions especially for the 1980s. However, a review of some empirical studies (IJAE, July-September 1985, and FCI Annual Reports) reveals that a major chunk in the marketing/distribution cost is that of interest and freight (above [illegible]). Freight is treated separately and is not included here because it will depend upon the distance covered by foodgrains while moving from one state to another. Interest is calculated for two months at the rate of 18 per cent on the procurement price of the grain. Handling expenses, storage charges, establishment charges, wholesaler's distribution margin and miscellaneous expenses, all are estimated at the rate of Re. 1 per quintal each. These expenses are added to interest cost derived earlier. Resulting set of figures indicating approximate marketing costs (excluding transport cost) and distribution margins, appears in Annexure 10.

2. Figures in parentheses are percentages to their respective procurement prices. The figures used in this paper are 6% for wheat and 5% for rice.

Annexure 11: Input Structure of Wheat (Average of 1981-82 to 1983-84)

(%)

Cost Inputs	Haryana	Madhya Pradesh	Punjab	Uttar Pradesh
Operational Cost	66.95	53.82	60.70	67.58
Human Labour	16.80	13.89	14.64	16.47
Bullock Labour	7.81	10.92	3.00	13.87
Machine Labour	10.54	2.44	12.37	7.42
Seed	7.84	10.80	4.57	6.51
Fertilisers	13.42	7.40	19.36	13.68
Manure	0.16	0.37	0.36	1.36
Insecticide	1.27	0.01	1.55	0.04
Irrigation charges	7.45	6.53	3.02	6.47
Interest on working capital	1.72	1.43	1.66	1.72
Miscellaneous	-	-	0.18	-
Fixed Cost	33.50	46.18	39.30	32.42
Rental value of owned land	21.08	33.07	23.29	21.75
Rent paid for leased in land	1.25	0.16	5.67	0.88
Land revenue, cesses & taxes	0.25	0.31	0.08	0.38
Depreciation on implements and farm buildings	1.70	4.22	1.82	2.22
Interest on fixed capital	8.77	8.40	8.44	7.16
Total cost (Rs/ha)	100.00 (3790.08)	100.00 (2977.88)	100.00 (4057.98)	100.00 (3681.87)
Cost C_2/q (Rs/q)	132.75	134.95	127.26	134.72
Procurement price (Rs/q)	148.33	148.33	148.33	148.33

Notes:
1. It may be remarked that machine labour includes operating expenses (fuel, lubricants etc), interest and depreciation of farm machinery like tractors, threshers etc.
2. The operating costs, depreciation and interest of irrigation pump, however, goes under the input item 'Irrigation charges'. Since this item also includes electricity or canal charges paid on account of irrigation, the cost of pump couldn't be separated out as tradeable input.
3. The cost items interest on fixed capital and Depreciation on implements and farm buildings, primarily relate to non-tradeable inputs like buildings on the farm etc.
4. Machine labour in this study has been approximated only by tractors.

Source: Comprehensive Scheme for the Study of Cost of Cultivation of Principal Crops in India, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Annexure 12: Input Structure of Paddy (Average of 1981-82 to 1983-84)

(%)

Cost items	Andhra Pradesh	Bihar	Madhya Pradesh	Orissa	Punjab	Uttar Pradesh
Operational Cost	65.47	51.51	57.39	61.03	63.87	63.25
Human Labour	25.53	24.85	22.93	29.20	20.09	26.42
Bullock Labour	7.16	13.36	15.91	14.52	2.26	13.76
Machine Labour	2.65	0.11	0.10	0.02	6.67	1.63
Seed	3.37	4.24	8.54	6.54	2.19	5.62
Fertilisers	15.24	4.97	5.72	3.44	15.41	8.07
Manure	4.12	1.04	2.42	5.02	1.46	2.41
Insecticide	1.81	0.02	0.33	0.28	2.09	0.14
Irrigation charges	3.67	0.74	0.16	0.54	11.94	3.72
Interest on working capital	1.89	1.19	1.39	1.46	1.74	1.47
Fixed Cost	34.53	48.49	42.61	38.97	36.13	36.75
Rental value of owned land	29.05	41.09	-	25.40	23.43	24.41
Rent paid for leased in land	0.38	0.26	32.02	7.08	4.60	0.90
Land revenue, cesses & taxes	0.63	0.88	0.13	0.28	0.06	0.47
Depreciation on implements & farm buildings	1.54	1.00	4.31	2.04	1.35	2.51
Interest on fixed capital	3.05	5.23	6.09	4.17	6.69	8.47
Total cost (Rs/ha)	100.00 (4519.15)	100.00 (2569.71)	100.00 (1695.90)	100.00 (2376.25)	100.00 (5920.70)	100.00 (2851.21)
Cost C_2/q (Rs/q)	125.09	125.25	106.95	115.39	109.50	117.46
Procurement price (Rs/q) of Rice	203.12	195.60	199.65	203.90	206.43	194.68

Notes: Same as in Annexure 11.

Source: Comprehensive Scheme for the Study of Cost of Cultivation of Principal Crops in India, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Annexure 13: Nominal Protection Coefficients of Fertilisers (N, P and K)

Particulars	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Urea (N) (46% Nitrogen)							
1. Landed cost (C & F) at Port	1896	2085	1380	1400	2000	2160	1340
2. Handling expenses* to pool handling agencies	750	900	900	900	1000	1000	1000 (2)
3. Dealer's Margin (3)	105	120	120	130	0	130	130
4. Domestic price	2000	2350	2350	2150	2150	2150 (1)	2350
5. NPC for the farmer 4/(1+2+3)	0.73	0.76	0.98	0.88	0.69	0.65	0.95
Di-ammonium Phosphate: P(DAP, 18-46-0)							
1. Landed Cost (C & F) at Port	2185	2206	2210	2050	2550	2490	2500
2. Handling expenses*	750	900	900	900	1000	1000	1000 (2)
3. Dealer's margin (3)	125	145	145	190	190	190	190
4. Domestic price	3050	3600	3600	3350	3350	3350 (1)	3600
5. NPC for the farmer 4/(1+2+3)	1.00	1.11	1.11	1.07	0.90	0.91	0.98
Muriate of Potash: K (60% K_2O)							
1. Landed cost (C & F) at Port	1192	1246	935	1000	1200	1350	1190
2. Handling expenses*	750	900	900	900	1000	1000	1000 (2)
3. Dealer's Margin (3)	80	90	90	95	95	95	95
4. Domestic price	1100	1300	1300	1200	1200	1200 (1)	1300
5. NPC for the farmer 4/(1+2+3)	0.54	0.58	0.67	0.60	0.52	0.51	0.57
Weighted Average NPC of Fertiliser (N, P and K) for the farmer	0.77	0.82	0.97	0.89	0.72	0.69	0.91

Notes:

* Pool handling charges basically consist of port handling and port dues, transit and storage losses, depot handling charges, finance charges, storage charges, freight, inventory holding cost, cost of bags and bagging, administrative overheads and contingencies etc.

1. These domestic prices are upto 31.1.1986.
2. Since 1.4.1986, Government introduced 'Tender System'. But we don't have any information about the prices that were finally given the contract. In view of this charges of 1985-86 are taken as the same for 1986-87 also.
3. Dealer's margin taken here is that of private dealers. For Cooperatives, it is generally a bit higher.
4. Landed prices (C & F) of imported fertilisers are calculated from Fertiliser Statistics, 1986-87 (p-1-70) for 1980-81 and 1981-82; for later years these are received from Ministry of Agriculture.
5. Weighted average NPCs are calculated by attaching weights to NPCs of N, P and K separately in the ratio of 0.67, 0.22 and 0.11 which is the ratio of their respective consumption levels averaged over 1980-81 to 1985-86.

Sources:

1. Department of Fertilisers, Ministry of Agriculture, Government of India.
2. Fertiliser Statistics, Fertiliser Association of India.
3. Fertiliser Association of India, New Delhi.

Annexure 14: NPCs of Tradeable Inputs of Wheat

State/Years		NPCs of Seeds	NPCs of Fertilisers (NPK)	NPCs of Farm Machinery (Tractors)	All Tradeable Inputs
1. Haryana	1980-81	0.75	0.77	1.26	0.92
	1981-82	0.76	0.82	1.26	0.95
	1982-83	0.89	0.97	1.26	1.04
	1983-84	0.89	0.89	1.26	1.01
	1984-85	0.79	0.72	1.26	0.91
	1985-86	0.79	0.69	1.26	0.90
	1986-87	0.98	0.91	1.26	1.04
Weighted (Average 1981-82 to 1983-84)		7.02	12.01	9.43	28.46
2. Madhya Pradesh	1980-81	0.69	0.77	1.26	0.78
	1981-82	0.70	0.82	1.26	0.80
	1982-83	0.80	0.97	1.26	0.91
	1983-84	0.80	0.89	1.26	0.88
	1984-85	0.72	0.72	1.26	0.78
	1985-86	0.71	0.69	1.26	0.76
	1986-87	0.80	0.91	1.26	0.89
Weights (Ave.	1981-82 to 1983-84	9.82	6.73	2.22	18.77
3. Punjab	1980-81	0.76	0.77	1.26	0.93
	1981-82	0.77	0.82	1.26	0.96
	1982-83	0.90	0.97	1.26	1.05
	1983-84	0.90	0.89	1.26	1.01
	1984-85	0.80	0.72	1.26	0.91
	1985-86	0.80	0.69	1.26	0.89
	1986-87	0.99	0.91	1.26	1.03
Weights (Ave.	1981-82 to 1983-84)	3.92	16.61	10.61	31.14
5. Uttar Pradesh	1980-81	0.70	0.77	1.26	0.88
	1981-82	0.71	0.82	1.26	0.91
	1982-83	0.82	0.97	1.26	1.01
	1983-84	0.81	0.89	1.26	0.97
	1984-85	0.73	0.72	1.26	0.86
	1985-86	0.73	0.69	1.25	0.85
	1986-87	0.88	0.91	1.26	0.99
Weights (Ave.	1981-82 to 1983-84)	5.91	12.42	6.74	25.07
Four States combined	1980-81	0.72	0.77	1.26	0.89
	1981-82	0.73	0.82	1.26	0.92
	1982-83	0.84	0.97	1.26	1.01
	1983-84	0.84	0.89	1.26	0.98
	1984-85	0.76	0.72	1.26	0.88
	1985-86	0.76	0.69	1.26	0.86
	1986-87	0.91	0.91	1.26	1.01
Weights (Ave.	1981-82 to 1983-84)	6.67	11.94	7.25	25.86

Note: The weights (average of 1981-82 to 1983-84) are the percentage shares of the relevant input's value in the procurement price of the output (wheat).

Annexure 15: NPCs of Tradeable Inputs of Rice

State/Years		NPCs			All Tradeable Inputs
		Seeds	Fertilisers (NPK)	Farm Machinery (Tractors)	
1. Andhra Pradesh	1980-81	0.45	0.77	1.26	0.78
	1981-82	0.52	0.82	1.26	0.82
	1982-83	0.77	0.97	1.26	0.97
	1983-84	0.72	0.89	1.26	0.90
	1984-85	0.74	0.72	1.26	0.79
	1985-86	0.81	0.69	1.26	0.78
	1986-87	0.82	0.91	1.26	0.93
Weights (Ave.	1981-82 to 1983-84	2.07	9.38	1.63	13.08
2. Bihar	1980-81	0.45	0.77	1.26	0.63
	1981-82	0.51	0.82	1.26	0.68
	1982-83	0.72	0.97	1.26	0.85
	1983-84	0.69	0.89	1.26	0.79
	1984-85	0.69	0.72	1.26	0.71
	1985-86	0.75	0.69	1.26	0.72
	1986-87	0.77	0.91	1.26	0.85
Weights (Ave.	1981-82 to 1983-84)	2.71	3.18	0.07	5.96
3. Madhya Pradesh	1980-81	0.46	0.77	1.26	0.58
	1981-82	0.50	0.82	1.26	0.63
	1982-83	0.74	0.97	1.26	0.83
	1983-84	0.70	0.89	1.26	0.77
	1984-85	0.71	0.72	1.26	0.71
	1985-86	0.77	0.69	1.26	0.74
	1986-87	0.79	0.91	1.26	0.84
Weights (Ave.	1981-82 to 1983-84	4.57	3.06	0.05	7.68
4. Orissa	1980-81	0.44	0.77	1.26	0.55
	1981-82	0.50	0.82	1.26	0.61
	1982-8.	0.72	0.97	1.26	0.80
	1983-84	0.68	0.89	1.26	0.75
	1984-85	0.69	0.72	1.26	0.70
	1985-86	0.75	0.69	.26	0.73
	1986-87	0.76	0.91	1.26	0.81
Weights (Ave.	1981-82 to 1983-84	3.70	1.95	0.01	5.66
5. Punjab	1980-81	0.49	0.77	1.26	0.87
	1981-82	0.55	0.82	1.26	0.91
	1982-83	0.83	0.97	1.26	1.03
	1983-84	0.78	0.39	1.26	0.98
	1984-85	0.79	0.72	1.26	0.87
	1985-86	0.87	0.69	1.26	0.86
	1986-87	0.90	0.91	1.26	1.00
Weights (Ave.	1981-82 to 1983-84	1.16	8.17	3.54	12.87
6. Uttar Pradesh	1980-81	0.45	0.77	1.26	0.70
	1981-82	0.50	0.82	1.26	0.74
	1982-83	0.73	0.97	1.26	0.91
	1983-84	0.69	0.89	1.26	0.85
	1984-85	0.70	0.72	1.26	0.77
	1985-86	0.76	0.69	1.26	0.77
	1986-87	0.78	0.91	1.26	0.83
Weights (Ave.	1981-82 to 1983-84	3.39	4.87	0.98	9.24
7. Six States combined	1980-81	0.45	0.77	1.26	0.72
	1981-82	0.51	0.82	1.26	0.77
	1982-83	0.75	0.97	1.26	0.93
	1983-84	0.70	0.89	1.26	0.87
	1984-85	0.77	0.72	1.26	0.79
	1985-86	0.78	0.69	1.26	0.78
	1986-87	0.80	0.91	1.26	0.91
Weights (Ave.	1981-82 to 1983-84	2.93	5.10	1.05	9.08

Note: The weights (average of 1981-82 to 1983-84) are the percentage shares of the relevant input's value in the procurement price of the output (Rice).

Chapter 3

INDIA : EFFECTIVE INCENTIVES FOR AGRICULTURE THE CASE OF COTTON

Introduction

3.01 This chapter attempts to quantify the degree to which the domestic market for Indian seed-cotton (kapas) during 1980s was delinked from world markets, thus resulting in a deviation or "distortion"[1] in domestic prices, compared to international prices. These distortions reflect the outcome of numerous policy measures pertaining to cotton that the Government undertakes from time to time. The measures range from export quotas and the imposition of minimum export prices on the one hand, to domestic support price and monopoly procurement, on the other. This chapter also attempts to quantify the impact of these Government policies by region and variety of cotton. To measure these distortions in prices, this study adopts the standard methodology[2] and estimates three different variants of protection coefficients of seed-cotton (kapas) - Nominal Protection Coefficients (NPCs), Effective Protection Coefficients (EPGs) and Effective Subsidy Coefficients (ESCs). In conjunction with the similar estimates for other crops, this helps in understanding the incentive structure across crops and regions in Indian agriculture. The effective incentives are different from what the cultivators actually receive in terms of return over cost. While the farmers generally respond to "Return Over Cost" signals, policy makers must go beyond "Return Over Cost" estimates and measure effective incentives; where foreign trade is viewed as a transformation frontier offering an opportunity to allocate resources more efficiently. Besides, these estimates can act as crude proxies[3] for cost-benefit indicators such as Domestic Resource Cost (DRC) and thereby indicate the degree of comparative advantage in the production of various crops in different regions. Thus, these estimates indicate the directions in which domestic policies, especially those relating to trade and pricing, deserve significant changes in order to evolve a more rational cropping pattern utilizing scarce resources of the country more efficiently.

3.02 The estimates of varietal and regional-specific protection coefficients obtained in this study indicate a situation of dis-protection for the Indian cotton cultivators. That is, domestic prices are less than international prices. This is true whether the comparison is versus imports (prices compared at Bombay) or exports (prices compared at a foreign port, in this case Japan). These results suggest that Indian cotton is an efficient export crop, as well as an efficient import substitute. The regional variation in effective incentives reveals that Maharashtra and Punjab are well above average while Andhra Pradesh is much below average. Thus the degree of dis-protection is greater for extra-long staple cotton growers (MCU-5 in Andhra Pradesh) than for the varieties grown in the northern and western belts. This result suggests that perhaps the greatest opportunity for expanding exports efficiently lies in stimulating greater production of the extra-long staple (MCU-5) variety of Andhra Pradesh.

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[1] The word "distortion" in this study is used to convey the meaning of a deviation in prices from what would otherwise prevail in absence of such regulatory policies, in particular from international prices.

[2] See Chapter 1, Scandizzo and Bruce, and Pursell and Roger.

[3] Effective subsidy coefficients when adjusted for shadow price of foreign exchange, are very close to cost-benefit indicators.

3.03 Section A of this chapter presents an introductory note on different aspects of cotton economy in India. Section B estimates region-specific NPCs for different varieties of seed-cotton (kapas). NPCs of tradeable inputs and EPCs of seed-cotton (kapas) are discussed in section C. Section D estimates subsidies on non-tradeable inputs and adjusts them to derive ESCs of seed-cotton (kapas). Finally, section E contains some concluding observations as also the future outlook of effective incentives for Indian cotton cultivators.

A. A Brief Introduction to the Indian Cotton Economy:

3.04 India ranks first in area (22.68%), fourth in production (10.16%) and sixty fourth in yield (with less than half of the average world yield) among the seventy eight countries that grow cotton.[4] During 1984-85 and 1985-86 (average), India's share in world cotton exports was a mere 1.3 per cent, while in carryover stocks its share was about 4.18 per cent.

3.05 Historically, India has been an exporter of raw cotton. As early as 1800 AD, India exported 150 thousand bales.[5] During the 19th century cotton cultivation in India expanded rapidly and 'covered almost 6 million hectares of land at the dawn of the twentieth century, yielding more than 3 million bales of cotton lint. And though home consumption was rising, about two-third of the production still sought export outlets'.[6] The Swadeshi movement during early years of the 20th century stimulated cotton cultivation and, by the end of 1920s, cotton covered an area of 10 million hectares. Production was about 5.5 million bales, of which almost two thirds was exported. The outbreak of the second World War reduced India's cotton exports severely. But the final blow came from partition of the country in 1947, when more than 25 per cent of the cotton acreage, covering the better part of the undivided India's cotton land, and nearly 40 per cent of the cotton production (most of which of long and medium staple varieties) was lost to Pakistan. India was left with over 98 per cent of the cotton textile industry.[7] This single event converted India into a net importer of cotton overnight. During the period 1951-52 to 1977-78 India imported, on average, 655 thousand bales against average annual exports of 255 thousand bales. Although Indian cotton experienced a technological break-through in 1968-69 with the release of Hybrid-4 and MCU-5 varieties, the real impact of this breakthrough on exports was felt only from 1978-79 onwards. During 1978-79 to 1987-88, India exported an average of 521 thousand bales per annum, against average imports of about 48 thousand bales per annum.[8] In October 1986, a long term cotton export policy was announced, under which the Government planned to export 600 thousand bales annually for three years beginning from 1986/87. However the 1987 drought and its aftermath reduced cotton production, and the government restricted exports to ensure domestic supplies at favorable prices for the textile producers.

3.06 The trading in cotton, both domestic and international, is subject to several Government interventions. For example, the Government

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[4] Figures relate to average of 1984-85 and 1985-86 cotton year. Cotton: World Statistics, International Cotton Advisory Committee, April, 1987.
[5] Madhoo Pavaskar (1985): Saga of the Cotton Exchange, Popular Prakashan, Bombay, p. 3.
[6] Op. cit. p. 5.
[7] Op. cit. pp. 10-11.
[8] Statement prepared by Directorate of Economics and Statistics, Ministry of Agriculture, Government of India (August 1988).

not only imposes quota restrictions on the exports of cotton but also stipulates minimum export prices (MEP). The Government releases the export quota in instalments over the cotton-year. It also allocates the released quota amongst various exporting agencies like Cotton Corporation of India (CCI), Maharashtra State Cooperative Cotton Growers Marketing Federation (MSCCGMF), Gujarat State Cooperative Cotton Federation (GSCCF), as well as private traders. For about a decade, private trade was not granted an export quota for long staple cotton. It was only in February 1986, facing a glut in the domestic market and in response to the repeated demands of private trade, that the Government allowed private traders to participate in the exports of long staple cotton, subject to a minimum export prices fixed by the Textile Commissioner, a bank guarantee at the rate of Rs. 250 per bale and a time limit of 90 days for shipment.[9] Even then its share was below 20 per cent in long staple cotton export quota (see Annexure 2). On the import front, the Government canalizes imports of cotton through its Cotton Corporation of India (CCI).

3.07 In the domestic cotton market, Government intervention starts with the fixation of support prices for seed-cotton,[10] followed by its procurement either in the open market by the CCI, or on a monopoly procurement basis as in Maharashtra.[11] These agencies also get raw

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[9] Director's Report, The East India Cotton Association Ltd., Indian Cotton Annual, 1984-85, No. 66, p. 5. These conditions were relaxed subsequently due to tough competition in the international market, e.g., MEP were reduced, then waived; the bank gurantee was reduced to Rs. 100.

[10] The Commission for Agricultural Costs and Prices (CACP) recommends support and international markets, etc. Exact weightage of these factors remains secret and varies over time. For 1988-89, minimum support prices were fixed for 32 varieties of seed-cotton, versus 40 for 1986-87 season.

[11] The CCI, which came into existence in July 1970, procures raw cotton at market prices which may be above or equal to the support prices. Maharashtra, however, follows monopoly procurement (since 1972-73) and, therefore, gets raw cotton from farmers at fixed prices. Till 1985-86 these were neither free market prices not the support prices announced by the Ministry of Agriculture (or Textile Commissioner), nor the prices paid by CCI. Instead, the Maharashtra Government used to fix its own cotton prices for the different varieties. The price fixation scheme also was a unique one. The Maharashtra State Cooperative Marketing Federation (MSCMF) assured a guaranteed price to cotton growers, 80% of which was paid to farmers on their tendering of kapas to MSCMF and the balance at the end of the season. After selling cotton, cotton-seed and cotton waste, the MSCMF announced a final price based on the prices actually realised by MSCMF from its sales. If the final price was greater than the guaranteed price, the difference was paid to the growers as bonus, after deducting a small amount (25%) for the Price Fluctuation Fund. If, on the other hand, the guaranteed price. The loss was made up either from Price Fluctuation Fund or from Government exchequer, if the Price Fluctuation Fund was not sufficient. In 1985-86 this scheme incurred a huge loss of Rs. 3.5 billion and the Government of Maharashtra set up a Committee to inquire into the resons which led to such a situation. From the 1986-87 season MSCMF has been given an extension, on the condition that its guranteed price will not be higher than the support price announced by CACP.

cotton processed into lint and distribute lint to many textile mills, especially those owned by the National Textile Corporation.

3.08 The degree of Central and State Government intervention in the domestic market is about 30 per cent and in the export market exceeds 80 per cent (see Annexures 3 and 4).

3.09 There are no zoning/movement restrictions in cotton marketing. Futures trading has not been permitted since 1966-67, despite favourable recommendations of the two expert committees on the subject headed by M.L. Dantwala in 1966 and A.M. Khusro in 1981,[12] and the comfortable supply situation during the 1980s[13] (except in 1987-88, which was an year of severe drought). This is because the Government always has considered futures trading as a speculative activity which did not serve any worthwhile cause either of the farmers or consumers. Non-transferable specific delivery contracts, however, were allowed with the concurrence of the Forward Markets Commission. The duration of delivery period was restricted to a maximum of three months from the date of signing the contract. The Cotton Textile Mills also face restrictions regarding the quantum of cotton (lint) stocks they can keep. This inventory limit used to vary between 1 to 3 months' consumption of mills in different regions of India, related to differentials in their proximity to major wholesale cotton markets. On 17th January, 1986, in view of the comfortable supply position, the Textile Commissioner raised the stock limit of cotton lint by mills to six months average consumption for all the mills.[14] Cotton textile mills as well as trade had been subjected to Selective Credit Control by Reserve Bank of India since 1965-66, with minor modifications in different years. It is only in the Policy Statement of April 1986, that cotton and seed-cotton (kapas) are exempted from the operation of Selective Credit Control.[15]

3.10 On the production front, cotton accounts for about 4.6 per cent of India's gross cropped area, which is the highest amongst all cash crops. It follows major cereals like rice (22.75%), wheat (13.55%), jowar (9.15%) and bajra (6.3%).[16] The total area under cotton has marginally declined over the last three decades from 8.09 million hectares in 1955-56 to 7.07 million hectares in 1986-87. Nevertheless, production increased from 4.18 million bales (of 170 kgs each) to 7.01 million bales over the same period (official statistics) and is estimated to have exceeded 10 million bales in 1988/89. This implies that there has been a significant rise in productivity over the period.

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[12] Pavaskar (1985), p. 103.

[13] Very recently, East India Cotton Association has been permitted futures trading in four varieties of cotton - H-4, DCH-32, MCU-5 and Shankar-6, w.e.f. June 1987 (see Times of India, May 1, 1987).

[14] Op. cit., p. 13.

[15] Directors' Report, the East India Cotton Association Ltd., Indian Cotton Annual 1984-85, p. 7.

[16] Figures relate to triennium ending 1984-85, Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

3.11 Across the different states, Maharashtra accounts for 35.8 per cent of all-India cotton area but contributes only 16.7 per cent to all-India cotton production, primarily because of an average yield (79 kgs/ha) which is less than half of the all-India average cotton yield (185 kgs/ha). On the other hand, Gujarat which accounts for 18.5 per cent of cotton area, contributes 21.7 per cent to all-India cotton production. Andhra Pradesh is next in its contribution to all India cotton production (13.8%), very closely followed by Punjab (13.3%).[17] A remarkable feature of Andhra's cotton economy is the phenomenal rate of growth in cotton production (12.8% p.a.) during 1967-68 to 1985-86, primarily supported by increasing yields (8.9% p.a.)[18] resulting from a technological break-through in extra-long cotton.

3.12 Much of cotton area in India is unirrigated (70.5%). Punjab and Haryana have the highest percentage of irrigated cotton area (97.5 per cent), with Maharashtra having only 4.7 per cent.

3.13 India produces a wide range of cotton varieties, which are grouped into five categories on the basis of their staple length. These are (a) Short Staple (below 19 mm); (b) Medium Staple (20 mm to 21.5 mm); (c) Superior Medium Staple (22m to 24mm); (d) Long Staple (24.5mm to 26mm) and (e) Superior Long Staple (above 27 mm). The north-western belt of India, comprising Punjab, Haryana and Rajasthan, specialises mainly in short and medium staple varieties, while the Southern and Western parts of India basically produce long and superior long staple varieties.[19]

3.14 The staplewise production and consumption pattern of cotton for the 1980s are presented in Annexure 7. Although production and consumption figures are not strictly comparable, as they are culled out from different sources, one can observe the changes in the two trends over time. Combining short and medium staple in one category, which has low counts and is used for making inferior cloth or handloom, one finds that production has lagged behind consumption. On the other hand, in total superior varieties -- medium, long and superior-long -- there is a relative surplus. The Government has been trying to overcome this varietal imbalance in demand-supply. For example, on the 25th June 1982, the Government readjusted the excise duty in a way such that the mill sector is induced to spin more superior medium and long staple, as well as to avoid underspinning[20]

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[17] All these figures relate to the average of 1983-84 to 1985-86, see Annexure 5.

[18] Andhra's growth rate of cotton production during 1977-78 to 1985-86 is even more remarkable (16.2% p.a.). (Based on production figures released by Directorate of Economics and Statistics upto 1983-84 and Cotton Advisory Board figures for 1984-85 and 1985-86).

[19] This classification does not conform exactly to the one adopted in International standards (see Annexure 6).

[20] (See CACP Report on Price Policy for Crops Grown in the 1983-84 Season, p. 23).

3.15 An interesting aspect of Indian cotton production statistics is that the official estimates differ significantly from those prepared by the trade, due to differences in the methodology adopted. There has been a systematic lower estimate in Government statistics ranging from 6.6% to 35.5% during 1980s (See Annexure 8).[21] The Seventh Plan (1985-90) assumed a base level production of 7.5 million bales in 1984-85 and kept a target of 9.5 million bales in 1989-90, giving a compound annual growth rate of 4.8%.[22] But in 1984-85 the actual production of cotton (as per official statistics) turned out to be 8.5 million bales, while the trade statistics, which are often considered more reliable, reveals that in 1984-85 the cotton production was 10.15 million bales and rose to 10.70 million bales in 1985-86. These figures far exceed the target of the 7th Plan set at 9.5 million bales for 1989-90.

B. Nominal Protection Coefficients of Seed-Cotton (kapas)

3.16 Following the methodology described in chapter 1, the nominal protection coefficient (NPC) of seed cotton, is defined as the ratio of the domestic price of cotton to the comparable international reference price of the relevant variety and is calculated below under two alternative hypotheses: (a) when domestic cotton is a substitute of foreign cotton and the two are expected to compete at Bombay (importable hypothesis) and (b) when domestic cotton is an exportable commodity and competes with foreign cotton at some foreign part, in this case Japan (exportable hypothesis). Accordingly, the relevant maritime freight, processing, marketing costs and trading margins are added to the international price to derive the cif Bombay price for the importable hypothesis but subtracted from the international price to derive the reference price for the exportable hypothesis.

3.17 Before proceeding to the estimation of NPCs for seed-cotton, a few remarks are in order. First, seed-cotton as such is not imported or exported; rather, international trade is primarily in cotton lint and sometimes in cottonseeds, but separately. Thus, seed-cotton is a joint product and, therefore, estimating its NPC amounts to calculation of NPCs of cotton lint and seeds both.

3.18 Second, cotton is traded internationally after ginning and pressing operations have been carried out. A precise estimation of protection coefficients of seed-cotton (kapas), therefore, also would involve estimation of the protection to the ginning and pressing industry, which needs to be adjusted in order to obtain precise measure of protection to cotton cultivators.[23]

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[21] In 1985, Government set up an expert committee to suggest measures for improving the quality of official estimates. The report has been finalised but was not formally submitted to Government by August 1988. The contents of the Report have not been released.

[22] See Seventh Five Year Plan, Vol. II, 1985-90, Planning Commission, Government of India, p. 5. Also see p. 7 for categorywise breakup of production targets.

[23] The present exercise skips this adjustment for want of time and resources.

3.19 Third, a choice regarding the appropriate varieties of cotton from domestic and international markets must precede estimation of NPCs of cotton so that the principle of "like is compared with the like" is upheld. The Annex to this chapter contains details of the selection of the domestic varieties and the comparable, foreign varieties and the calculations of the adjustments for freight and processing under the two hypotheses.

3.20 The estimation of weighted NPCs for Indian cotton under the importable and exportable hypotheses is carried out by attaching value weights to the region and variety specific NPCs obtained for 1980s. The value weights are derived as the relative shares of different varieties in total value of seed-cotton processed, value being calculated at international reference prices (See Annexure 20).

3.21 The resulting set of NPCs (Table 3.1) indicate an overall situation of disprotection to Indian cottons i.e. domestic prices are lower than external prices. This conclusion is true under both the importable and exportable hypotheses. Hence Indian cotton would be a highly efficient export but for the barriers that delink the domestic and the world market.

3.22 The degree of disprotection is greatest in the case of extra-long staple cottons like MCU-5 being grown in the southern belt. This is followed by J-34/320F/Punjab American of the north and then the S-4/6 and H-4 varieties of western parts of India. During 1981-82, there was marginal protection in S-4/6 and J-34/320F under the importable hypothesis. However, the disprotection of MCU-5 swamped the small protection to other varieties, making the overall picture one of disprotection even in 1981/82. Under the exportable hypothesis, the result that emerges is disprotection for most years (except, 1981/82 and 1985/86). The seven year (1980-81 to 1986-87) average NPCs for Maharashtra and Gujarat do exhibit positive protection under the exportable hypothesis. But when Andhra Pradesh is grouped with other three states, the weighted average NPC moves below unity (0.92), indicating disprotection on balance for cotton cultivators under the exportable hypothesis.

Table 3.1: Nominal Protection Coefficients of Seed-Cotton (Kapas)

Hypothesis/State	Cotton	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis									
Maharashtra	H-4	0.88	0.99	0.89	0.81	0.93	1.31	0.93	0.96
		(0.21)	(0.21)	(0.21)	(0.13)	(0.17)	(0.17)	(0.17)	(0.18)
Gujarat	Shankar-4	0.93	1.02	0.88	0.80	0.77	0.93	0.87	0.89
		(0.15)	(0.15)	(0.15)	(0.18)	(0.24)	(0.25)	(0.25)	(0.20)
Punjab	J-34/320F	0.71	1.06	0.85	0.72	0.83	0.80	0.82	0.83
		(0.34)	(0.34)	(0.34)	(0.26)	(0.31)	(0.34)	(0.34)	(0.32)
Andhra Pradesh	MCU-5	0.68	0.72	0.71	0.57	0.48	0.55	0.73	0.63
		(0.30)	(0.30)	(0.30)	(0.43)	(0.28)	(0.24)	(0.24)	(0.30)
Weighted Average		0.77	0.94	0.82	0.68	0.73	0.86	0.83	0.80
Exportable Hypothesis									
Maharashtra	H-4	1.05	1.24	1.00	0.90	1.08	1.60	1.07	1.13
		(0.21)	(0.21)	(0.21)	(0.13)	(0.17)	(0.17)	(0.17)	0.18
Gujarat	Shankar-4	1.11	1.26	0.99	0.88	0.88	1.10	0.98	1.03
		(0.15)	(0.15)	(0.15)	(0.18)	(0.24)	(0.25)	(0.25)	(0.02)
Punjab	J-34/320F	0.85	1.33	0.99	0.81	0.97	0.95	0.95	0.98
		(0.34)	(0.34)	(0.34)	(0.26)	(0.31)	(0.34)	(0.34)	(0.32)
Andhra Pradesh	MCU-5	0.73	0.77	0.74	0.59	0.50	0.58	0.76	0.67
		(0.30)	(0.30)	(0.30)	(0.43)	(0.28)	(0.24)	(0.24)	(0.30)
Weighted Average		0.89	1.13	0.92	0.74	0.83	1.01	0.93	0.92

Note: Figures in parentheses are value weights at international reference prices (See Annexure-20). For 1980-81 and 1981-82 weights used are those of 1982-83; and for 1986-87 these are of 1985-86, due to lack of required information for these years.

C. Effective Protection Coefficients (EPCs)

3.23 As shown in Chapter 1, equation 2, the Effective Protection Coefficient is defined as the ratio between value added at domestic prices to value added at world prices (reference prices), where value added is estimated as the difference between value of output and its traded (tradeable) inputs. Hence, the estimation of NPCs above can be used, in conjunction with estimates of the protection on imports, to derive EPCs for seed-cotton. The variety and region-specific cost structures of

seed-cotton (kapas) (Annexure 25) reveal that the major tradeable inputs are plant protection chemicals (insecticides and pesticides), fertilizers, farm machinery (machine labour) and seeds. For farm machinery and fertilizers, NPCs are the same as those derived in the previous chapter for wheat and rice. For cotton-seeds the NPCs as estimated in Annexures 14 and 15 are used. Thus, plant protection chemicals are the only tradeable input that requires in depth analysis. The Annex describes the methodology and the approach used to calculate effective protection using the formula in Chapter 1. The results are summarized in Table 3.2. As the NPCs of seed-cotton are different under the importable and exportable hypotheses, separate estimates of EPCs under the two hypotheses as shown in Table 3.2.

Table 3.2: Effective Protection of Coefficients of Seed-Cotton (Kapas)

Hypothesis/State	Variety	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86...1986-87		Average
Importable Hypothesis									
Maharashtra	H-4	0.85	0.96	0.85	0.78	0.91	1.31	0.89	0.93
Gujarat	S-4/6	0.65	0.73	0.60	0.54	0.52	0.65	0.59	0.61
Punjab	J-34/32F	0.62	0.97	0.78	0.62	0.74	0.71	0.72	0.74
Andhra Pradesh	MCU-5	0.57	0.61	0.60	0.51	0.40	0.46	0.62	0.54
Weighted Average		0.66	0.82	0.71	0.58	0.62	0.74	0.69	0.69
Exportable Hypothesis									
Maharashtra	H-4	1.03	1.23	0.97	0.87	1.07	1.65	1.04	1.12
Gujarat	S-4/6	0.82	0.97	0.70	0.61	0.61	0.81	0.66	0.74
Punjab	J-34/32F	0.75	1.28	0.89	0.71	0.88	0.86	0.85	0.89
Andhra Pradesh	MCU-5	0.62	0.66	0.63	0.49	0.41	0.48	0.65	0.56
Weighted Average		0.78	1.04	0.80	0.62	0.71	0.89	0.79	0.80

Note: Weights are the same as in Table 3.1.

3.24 Table 3.2 suggests that the incentives to produce cotton are even less than the NPCs indicate; i.e. EPCs turn out to be lower than NPCs for relevant cotton varieties in different states. This is because the protection accorded tradeable inputs is greater than the nominal protection of seed-cotton, in this case seed cotton receives negative nominal protection while inputs are protected.

3.25 The regional and varietal dispersion of average EPCs, under both the importable and exportable hypotheses, is fairly large. For example, average (1980-81 to 1986-87) EPCs under importable hypothesis range between 0.54 for Andhra Pradesh (MCU-5) to 0.93 for Maharashtra (H-4). A similar pattern emerges under the exportable hypothesis. This suggests distortion in the varietywise pricing of seed-cotton (kapas) in India.

D. Effective Subsidy Coefficients (ESCs)

3.26 Variety and region-specific Effective Subsidy Coefficients of seed-cotton are estimated by adjusting EPCs for subsidies on non-tradeable inputs (irrigation, electricity and credit), as shown in chapter 1, equation 3. Subsidies on irrigation and electricity are derived by estimating the difference between their respective resource costs and revenue receipts; the credit subsidy is deemed to consist of interest subsidy and default subsidy.[24]

3.27 The estimated subsidies (Table 3.3) exhibit a wide variation across states. Punjab cotton, for example, gets a subsidy that is almost four times that of what Andhra Pradesh cotton receives. The difference is mainly due to the estimated irrigation subsidy, which varies significantly depending upon the extent of irrigated area under cotton in the states.

3.28 Taking into account the subsidies, one can calculate ESCs of seed-cotton under the importable and exportable hypotheses (Table 3.4). The weighted average ESCs are below unity for all years under consideration (except 1981-82, under the exportable hypothesis only). Maharashtra cotton (H-4) and Punjab cotton (J-34/320F) have ESCs greater than unity under exportable hypothesis (average 1980-81 to 1986-87), while long staple cotton of Andhra Pradesh (MCU-5) has the lowest ESCs under both the importable and exportable hypotheses. The results broadly indicate that ESCs, though higher than EPCs, still remain below the NPCs (weighted average) under both the importable and exportable hypotheses.

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[24] For greater details on statewise estimation of subsidies, see Gulati. It may be mentioned here that allocation of irrigation subsidy across crops is done on the basis of water requirement (so called water weights) of the different crops while the credit subsidy is allocated on the basis of their relative value.

Table 3.3: Subsidies on Non-tradeable Inputs of Seed-Cotton (Kapas)

(Rs. per quintal)

States	Cotton Variety	Input Subsidy	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Maharashtra	H-4	IS	4.65	5.09	5.37	5.77	6.17	6.63	7.10
		ES	0.18	0.24	0.33	0.38	0.47	0.58	0.59
		CS	13.94	13.13	17.16	17.54	19.83	21.90	21.90 *
		TS	18.77	18.46	22.86	23.69	26.47	29.11	29.59
Gujarat	S-4/6	IS	11.26	12.08	12.95	13.88	14.88	16.97	17.08
		ES	0.29	0.14	0.28	0.28	0.43	0.50	0.45
		CS	9.33	8.24	11.43	11.37	10.30	16.78	16.78 *
		TS	20.88	41.34	24.66	25.53	25.61	34.25	34.31
Punjab	J-34/320F	IS	39.06	42.05	51.06	86.77	39.48	45.38	41.99
		ES	2.62	2.7	3.70	6.38	3.34	4.31	4.13
		CS	7.2	8.23	6.76	11.28	9.99	8.25	8.25 *
		TS	48.88	52.98	61.52	104.43	52.81	57.94	54.37
Andhra Pradesh	MCU-5	IS	3.06	2.79	2.54	2.31	2.10	1.91	1.74
		ES	0.04	0.05	0.06	0.07	0.07	0.06	0.07
		CS	12.16	10.38	13.03	13.5	15.56	16.72	16.72 *
		TS	15.26	13.22	15.63	15.88	17.73	18.69	18.53

* assumed to be the same as that for 1985-86 due to lack of required information.

IS = Irrigation Subsidy ES = Electricity Subsidy
CS = Credit Subsidy TS = Total Subsidy

3.29 Subsidies thus partially offset the impact of input costs that exceed world market prices. It must be recalled that subsidies affect different regions and farmers differently, and the use of the average subsidy calculations overstates the benefit to the marginal farmer and thus the impact of subsidies on prices (para 1.26). Nonetheless, these results have important implications, which are discussed in the next section.

Table 3.4: Effective Subsidy Coefficients of Seed-Cotton (Kapas)

Hypothesis/State	Cotton Variety	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis									
Maharashtra	H-4	0.89	1.00	0.89	0.81	0.95	1.39	0.95	0.98
Gujarat	S-4/6	0.70	0.84	0.65	0.58	0.56	0.74	0.65	0.67
Punjab	J-24/320F	0.70	1.11	0.93	0.79	0.83	0.83	0.82	0.86
Andhra Pradesh	MCU-5	0.59	0.63	0.62	0.53	0.41	0.48	0.63	0.55
Weighted Average		0.71	0.90	0.79	0.64	0.67	0.82	0.75	0.75
Exportable Hypothesis									
Maharashtra	H-4	1.07	1.28	1.01	0.91	1.12	1.73	1.10	1.17
Gujarat	S-4/6	0.88	1.11	0.75	0.65	0.66	0.92	0.73	0.81
Punjab	J-34/320F	0.86	1.46	1.07	0.90	1.00	1.01	0.97	1.04
Andhra Pradesh	MCU-5	0.64	0.68	0.65	0.51	0.43	0.50	0.66	0.58
Weighted Average		0.84	1.13	0.88	0.69	0.78	0.99	0.86	0.88

Note: Weights are the same as in Table 3.1.

E. Concluding Remarks and Future Outlook

3.30 Effective incentives, as measured by the various protection coefficients under both the importable and exportable hypotheses, indicate that, Indian cotton cultivators have experienced disprotection or "net taxation" on average during 1980s (1980-81 to 1986-87). This situation has emerged as a consequence of distortions in the market brought about by regulatory policies of the Government, especially those pertaining to the pricing and trade of raw-cotton. The degree of "net taxation" is greater under the importable hypothesis (weighted ESC = 0.75) than under exportable hypothesis (weighted ESC = 0.88).

3.31 Across states, incentives are dispersed widely. Maharashtra cotton cultivators received incentive levels 30 per cent more than the (weighted) average incentives available to Indian cotton cultivators (Table 3.5). Compared to Andhra Pradesh (with ESC = 0.55), Maharashtra's cotton growers enjoyed incentive levels that were 78 per cent higher under the importable hypothesis and 102 per cent higher under the exportable hypothesis. Such a wide difference across the regions in effective incentives was mainly due to the monopoly procurement scheme of MSCMF with its unique system of pricing in terms of guaranteed and final prices (for details see footnote 11). It may be recalled here that this scheme resulted in huge losses to MSCMF totalling Rs. 3.5 billion in a single year (1985-86). It is precisely in this very year that Maharashtra had the highest ESC of all (1.39 under the importable hypothesis and 1.73 under the exportable hypothesis). Clearly, the high protection extended to Maharashtra cotton growers was at the expense of Government exchequer, for which the Federation has had to face an enquiry committee.

3.32 Temporally, the behaviour of effective incentives (weighted average ESCs) follow an "M" shape curve. Under the importable hypothesis they start at a level of 0.71 in 1980-81, suddenly shoot up to 0.90 in 1981-82, gradually decline to 0.79 in 1982-83 and further to 0.64 in 1983-84. Thereafter for two successive years they improve to 0.82 in 1985-86 and then again fall to 0.75. (Table 3.6). Under the exportable hypothesis, the pattern is similar, although the level of effective incentives is higher. On an average, during the 1980s, ESCs under both hypotheses remained below unity, indicating that cotton is not only an efficient import substitute but also an efficient exportable commodity.

3.33 The delinking of the domestic and world market thus reduced the returns available to producers of cotton and hence lowered the resources devoted to cotton production, compared to what would have prevailed under a more open economy. Since incentives to cotton diverged more from world market prices than other "competitive" crops (e.g. wheat, rice, groundnuts), an adjustment of relative prices would have increased efficiency and brought a net foreign exchange benefit to the economy.

3.34 The foregoing calculations do not take into account any scarcity premium for foreign exchange -- they use the official exchange rate. Allowing for a premium of say 25 per cent on foreign exchange would increase the divergence between domestic and world prices and imply even greater benefits would be obtained from devoting more resources so cotton production. In particular, the adjusted ESCs would imply that investment programs to grow cotton, especially long staple, would yield a high economic rate of return. In this context, it may be mentioned that cotton being a commercial crop would almost certainly respond to price signals rather quickly. It also has capacity to provide more employment due to its labour intensive crop technology. What is therefore required is a change in the pricing and/or trade policies relating to cotton, so that the extent of distortions in pricing of raw cotton can be reduced.

Table 3.5: Regional Dispersion of Effective Incentives for Cotton Cultivators (Average 1980-81 to 1986-87).

Particulars	NPCs	EPCs	ESCs	Index of ESCs (weighted (Av=100)	Cotton Variety Domestic	International
Importable Hypothesis						
Maharashtra	0.96	0.93	0.98	130.67	H-4	Mexican
Gujarat	0.89	0.61	0.67	89.33	S-4/6	California (SM 1 1/8")
Punjab	0.83	0.74	0.86	114.67	J-34/320F	Orleans/Texas (1")
Andhra Pradesh	0.63	0.54	0.55	73.33	MCU-5	Giza 67/69/81
Weighted Average	0.80	0.69	0.75	100.00		
Exportable Hypothesis						
Maharashtra	1.13	1.12	1.17	132.95	H-4	Mexican
Gujarat	1.03	0.74	0.81	92.04	S-4/6	California (SM 1 1/8")
Punjab	0.98	0.89	1.04	118.18	J-34/320F	Orleans/Texas (1")
Andhra Pradesh	0.67	0.56	0.58	65.91	MCU-5	Giza 67/69/81
Weighted Average	0.92	0.80	0.88	100.00		

3.35 To start with, a beginning can be made in case of superior long and extra-long staple cottons like MCU-5, DCH-32 and Suvin etc. In this context, the Government's decision to export 600 thousand bales from 1986-87 season was a welcome step. Leaving aside exceptional years like the drought of 1987-88, when the cotton crop fails, the policy of exporting staple cotton should be followed. Another welcome step on the part of Government is to provide extension to MSCMF on the condition that it aligns its guaranteed price to the support price announced by Central Government. Although, these recent changes in regulatory policies are in right direction, more is needed, especially on export front. Conditions on the export-quota, its allocation by the Government amongst various exporting agencies, the imposition of the minimum export price etc. at times become so stringent and suffocating that their ultimate effect does not percolate down to the cultivators. Hence, a more liberal set of policies governing exports of raw cotton is required, if cotton cultivators are to be offered higher incentives and cotton is to become an important export.[25]

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[25] Incidentally, promoting cotton exports and cotton production would contribute to edible oil production marginally. This is because cotton is a joint product and any efforts to promote its production also would increase the supply of cottonseeds, and thus edible cottonseed oil.

Table 3.6 Temporal Behaviour of Protection Coefficients (Weighted Average)

Particulars	1980-81	1980-81	1981-82	1982-83	1983-84	1984-85	1986-87	Average
Importable Hypothesis								
NPCs	0.77	0.94	0.82	0.68	0.73	0.86	0.83	0.80
EPCs	0.66	0.82	0.71	0.58	0.62	0.74	0.69	0.69
ESCs	0.71	0.90	0.79	0.64	0.67	0.82	0.75	0.75
Exportable Hypothesis								
NPCs	0.89	1.13	0.92	0.74	0.83	1.01	0.93	0.92
EPCs	0.78	1.04	0.80	0.62	0.71	0.89	0.79	0.80
ESCs	0.84	1.13	0.88	0.69	0.78	0.99	0.86	0.88

									Short term projection			Long Run	
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1995	2000
International price of cotton at 1985 constant dollars (cotton outlook index A cif Liverpool) (c/Kg)	196	176	155	184	180	132	89	126	113	105	117	158	153

Source: Half Yearly Revision of Commodity Price Forecasts - Jan. 1988, The World Bank (for international price of cotton).

3.36 What is likely to be the future scenario? Cotton prices in the world market at 1985 constant dollars, have fluctuated. Sharp movements could affect the protection coefficients of Indian cotton. Short-term projections by the World Bank (January 1988) indicate that cotton prices are likely to remain depressed during 1988 to 1990. Although these prices are likely to be higher than those prevailing during 1986, they are likely to be lower than 1987 prices, and significantly lower than those in 1983. Even in the long run, real world cotton prices are not likely to touch their 1983-84 levels, though they are expected to be much higher than those that are likely to prevail during late 1980s. However, at no point in time until 2000 AD, are world cotton prices are likely to touch the trough they fell into during 1986. This forecast suggests that Indian cotton is likely to remain disprotected unless significant changes are undertaken in policies governing domestic prices and international trade. This is particularly true if one allows for a premium on foreign exchange. In sum, cotton is likely to remain an efficient import substitute and, most likely, an efficient exportable commodity. Hence the economic rate of return on investment programs promoting cotton production is likely to remain high.

ANNEX

A. Comparable Varieties of Froeign Cotton

Four varieties are selected from domestic market, which belong to different staple length groups and are quite dominant in the important cotton growing tracts of India: J-34/320F with a staple length ranging between 22 mm to 23 mm from the north (Punjab-Haryana tract); Hybrid-4 (26 mm to 28 mm) from Maharashtra, Shankar-4/6 (29 mm to 31 mm) from Gujarat and MCU-5 (32 mm to 34 mm) from Andhra Pradesh. While Punjab American (J-34/320F) belongs to the superior medium groups by Indian standards, the otner varieties fall in the superior long staple group (above 27 mm). However, as per international classification, J-34/320F would belong to medium staple group, H-4 to medium long staple group and S-4/6 and MCU-5 to long staple group (see Annexure 6).

Which foreign cotton varieties are comparable to the four Indian varieties cited above? East India Cotton Association (EICA), which is the biggest cotton Association of traders in India, has a reference guide on this subject.[1] According to this guide, MCU-5 (superior) which is widely grown in Andhra Pradesh and Tamil Nadu, has a staple length between 32 mm to 34 mm, micronaire 3.0 to 3.5 and spinning counts of 50s to 60s is comparable to Giza 69/67 and Sudan 6B. Depending upon the availability of price series in the international market, Giza 67/69/81 is selected for comparison with MCU-5.

The fact that DCH-32, which is considered superior to MCU-5, is quoted much lower than Giza 67/69/81 in the international market (Liverpool cotton services), sometimes may cast doubts about the reliability of varietal comparisons that is made here. But talks with the exporters revealed that, although qualitatively, MCU-5 is comparable to Giza 67/69/81, it fetches a lower price because of the following reasons: (a) European market is relatively conservative, especially in the use of superior varieties. They have been using Egyptian cotton for a long time and changing to new varieties like Indian MCU-5, would be difficult and take some time; (b) The above factor of difficult entry into an already captured market becomes more important because of irregular and uncertain supply of Indian superior cotton in the international market. Since the use of any particular cotton variety requires some changes/adjustments in the machinery using it, the user wants to have a regular flow of that variety at least for a couple of years, which Indian cotton exporters can't ensure. In this regard, exporters were of the opinion that the long term cotton export policy of October 1986, which commits to a minimum export of 600 thousand bales per annum, would be of some benefits; (c) Quite often Indian exporters can't keep up the delivery schedule, which has affected adversely the demand and therefore the price of Indian superior cotton; (d) Lack of strict standardisation procedure is also responsible for its lower price. Since cotton of the same variety differs from state to state due to differences in moisture/agro-climatic reasons,

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[1] Introducing Indian Cottons: Higher Medium to Extra Long Staple, EICA (undated). It is specially prepared to introduce Indian cottons to foreigners in the wake of emerging Indian cotton exporters. This booklet is revised in 1986, deleting some varieties which have gone out of cultivation and inducting some new varieties which have been permitted for exports.

any mixing of these distorts the true lustre of the fibre and thus lowers its acceptability in the international market; (e) domestic restrictions of MEP and export quotas, which are released in instalments and remain uncertain till the last moment, and the shipment period of 90 days from the date of issue of the registration certificate, all go against the competitive strength of Indian exports, which ultimately results in lower prices of Indian superior cottons in relation to comparable foreign cottons in international markets.

The EICA guide compares Shankar-4 (superior) which has staple length of 29 to 31 mm, micronaire 3.8 to 4.2 and spinning counts 44s to 60s with California Acala SJV, Elpaso and Colombia Acala. In this study Shanker-4 is compared with California 1 1/8" being quoted in Liverpool. On the other hand, H-4 (average) with staple length 26 to 28 mm, micronaire 3.1 to 3.9 and spinning counts 34s to 44s is compared with Mexican cotton as appearing in Liverpool quotations. Finally, J-34/320F/Punjab American with staple length of 22 mm to 23 mm, micronaire between 3.5 to 4.3 and spinning counts of 24s to 28s, is compared with Orleans/Texas (1") middling.

B. Freight and Processing Adjustments

The first requirement NPCs is the calculation of reference prices of relevant foreign cottons under importable and exportable hypotheses. These are derived as follows : Cotton Outlook (Liverpool Publication) contains cif (Liverpool) prices for various internationally significant varieties of cotton. In comparing Shankar-4 with California, H-4 with Mexican and J-34/320F and Orleans/Texas (1") Middling, the maritime freight (Annexure 9) from North Europe to US South-west coast is deducted and the freight from US south-west coast to India (Bombay) is added in cif (Liverpool) prices of foreign cottons.[2] This provides cif (Bombay) price of relevant foreign cottons for the specific months that correspond to peak marketing periods of comparable Indian growths. From this is deducted the domestic processing, marketing costs and trading margins (as derived in Annexures 10 to 13) for different states, separately. These costs include ginning and pressing charges together with the accompanying overheads, market cess, purchase incidentals, labour charges, brokerage, insurance, interest on capital deployed, storage, transport (road/rail) charges etc. The rest is trading margin.[3] After deducting all these, the resulting set of figures are the lint values of importable cottons at region-specific ginneries. To move from lint to seed-cotton (kapas), one requires similar information on cottonseed. But such information, especially on variety-specific international prices of cotton-seeds, is not available as international trading in this commodity is very scanty.

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[2] In the case of Giza 67/69/81 comparison with MCU-5, maritime freight from North Europe to North Africa is decucted from North Africa to India is added.

[3] It may be observed in these Annexures that processing, marketing costs and trading margins as a ratio of the value of cotton lint and seeds in 1980s is comparable to what prevailed during sixities (Pavaskar and Radhakrishnan, 1970, pp. 19-22) or during seventies (Indian Merchants Chamber, 1978, PAtel and Pandey, 1978), Singh et al 1979, pp. 50-51; Pavaskar, 1981, pp. 31-43; Ranade et al 1982, pp. 69-73).

However, we have the cottonseed prices prevailing in US markets during the period 1980-81 to 1985-86. In order to obtain fob (US gulf) price of cottonseed, an approximate expenditure of 3 per cent towards fob expenses is added in the US domestic price of cottonseed. Maritime freight from US gulf to India is assumed to be roughly 15 per cent higher than what existed for wheat (FAO series) during 1980s.[4] Annexures 14 and 15 provide details of cottonseed prices. Adjusting fob expenses and maritime freight rates as applicable under importable and exportable hypotheses, one obtains relevant reference prices of cottonseed. Adding reference prices of 100 kgs of cotton lint (variety and region-specific) and reference price of 190.3 kgs of cottonseeds, one gets reference price of 294 kgs of seed cotton (kapas), under the assumption that lint ginning ratio is 34 per cent and ginning loss is 1.3 per cent. Divising domestic prices of variety-specific seed-cotton (kapas) in different regions by relevant reference prices of seed-cotton (kapas), the resulting figures obtained are the NPCs of variety and region-specific seed-cotton (kapas) under importable and exportable hypotheses (Annexures 16 to 19 and 21 to 24).

The available information on imports and exports of pesticides, especially cif and fob prices, is not sufficient enough to enable precise estimation of NPCs of the particular insecticides that are used for cotton plant protection. The major pest attacks from which cotton cultivation in India has to be protected is that of pink bollworm and/or spotted bollworms.[5] Important insecticides to control this pest are: Carbaryl, Eudosulfan, Phosalone and Monocrotophos. A weighted average NPC of Endosulfan, Phosalone and Monocrotophos is derived for 1983-84 on the basis of the scanty information could be gathered. The NPC turns out to be 2.7, which is utilised in this study for 1980-81 to 1986-87.[6]

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[4] This premium of 15 per cent, which is an approximate figure, is assumed because (a) cottonseed is lighter and more voluminous compared to wheat; (b) trading in cottonseed is less frequent than in wheat and (c) cottonseed trading is in smaller quantities than that of wheat. All these factors are responsible for higher maritime freight for cottonseed than for wheat.

[5] Pale or pink coloured caterpillars damage squares, bolls and cotton seeds. It leads to premature shedding of squares and bolls. The damaged seed-cotton (kapas) gives lower ginning percentage, lower oil extraction and inferior spinning quality. (See Cotton, The Fertilizer Association of India (1984), pp. 89-90).

[6] There is no information on Carbaryl. But we do have some prices for 1983 prevailing in US domestic market for the other three insectidices (World Bank). Adding 30% of those prices for fob expenses, insurance and freight from US to India, we have worked out the approximate cif prices of these insecticides. Comparing these with the corresponding Indian domestic prices during 1983 (derived from DGTD Report 1982-84), we computed NPCs of Endosulfan (1.85), Phosalone (2.63) and Monocrotophos (4.60), separately. Attaching approximate weights of 0.5, 0.25, and 0.25 to these to account for their relative use in cotton plan protection, we derived a weighted NPC of 2.7 for insecticides. This was cross-checked from the import data (Quantity and value) obtained from Pesticides Association of India for the year 1985-86, and domestic prices from National Organix Chemical Industries Ltd. and Rallies India Ltd. The protection coefficient of 2.73 seemed quite reasonable.

Once NPCs of different tradeable inputs are obtained (Annexure 26), their weighted NPCs are estimated by attaching value weights to the NPCs of individual tradeable inputs. The value weights for different tradeable inputs (Annexure 27) are calculated as share of each such input in domestic selling price of relevant seed-cotton (kapas) variety, averaged over 1981-82 to 1983-84. Since input cost structures for different cotton varieties in different states (Annexure 25) differ significantly and since domestic selling prices of relevant seed-cotton varieties also differ, the resulting weights make NPCs of all tradeable inputs (together) significantly different across states. For example, while Maharashtra has an average (1980-81 to 1986-87) NPC of 1.34, Andhra Pradesh exhibits an NPC as high as 2.00 closely followed by Gujarat (1.98) (Annexure 26). This is because both in Gujarat and Andhra Pradesh, expenditure on plant protection chemicals (insecticides) is very high and this input has the highest protection coefficient too. Higher expenditure on insecticides is incurred presumably due to frequent pest attacks on cotton of these regions due to the very agro-climatic reasons. This raises overall share of tradeable inputs in domestic price of seed-cotton in these two states (Gujarat and Andhra Pradesh) much higher than in other states.

The estimated NPCs of tradeable inputs (Annexure 26) and NPCs of seed-cotton (Table 1) are plugged-in to equation (2) of chapter 1 to calculate EPCs of seed-cotton. It should be noted that NPCs of seed-cotton are different under the importable and exportable hypotheses and, accordingly, application of above equation would provide separate estimates of EPCs under the two hypotheses as shown in Table 3.2.

Annexure 3.1: Balance Sheet of Cotton in India

Hundred thousand bales of 170 Kgs each)

Particulars	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1. Estimated carry over on last September	27.40	22.3a	27.20	25.41b	16.00c	28.38d	39.50e	20.00f
2. Estimated crop production (g)	77.80	84.00	86.50	75.16	101.50	107.00	95.00	90.00
3. Imports	-	0.50	-	-	1.00	-	-	3.00
4. Total supply	105.20	106.80	113.70	100.57	118.50	135.83	134.50	113.00
5. Consumption by Mills	76.80	71.20	75.60	80.06	86.50	86.57	95.00	92.00
6. Extra-Factory consumption (including Ambar Charkha, Surgical dressing factories and waste spinning units)	3.50	4.70	4.70	4.85	4.85	5.1(B)	5.5(B)	5.5(B)
7. Exports	7.9a	3.70	6.60	3.57	2.95	4.50	14.47	0.43
8. Total off-take	88.20	79.60	86.90	88.28	94.10	96.17	114.97	97.93
9. Carry over on 31st August	17.00	27.20	26.80	12.29	24.40	39.66	19.53	15.07

a = [illegible] adjustment
b = Figures of C.A.B. Meeting held on 1.10.84
c = Figures of C.A.B. Meeting held on 20.8.85
d = Figures of C.A.B. Meeting held on 9.1.87
e = Figures of C.A.B. Meeting held on 19.8.87
f = Figures of C.A.B. Meeting held on 11.8.88
g = Trade estimates (Commercial Production excluding domestic consumption)
(B) = Non-Factory consumption

Source: Directorate of Economics & Statistics, Ministry of Agriculture, Government of India.

Annexure 3.2: Agencywise and Varietywise Export Quota Announced for 1985-86 Season

(No. of Bales of 170 Kgs each)

Exporting Agency	Cotton Variety					Total
	Staple Cotton	Bengal Deshi	Yellow Pickings	Soft Cotton Waste	Hard Cotton Waste	
Cotton Corporation of India	4,50,000	39,000	5,000	*		4,94,000
MSCMF	5,23,904					5,23,904
Gujarat Federation	1,11,000 (-27,904)					83,096
Andhra Pradesh	20,000 (-16,562)					3,438
Tamil Nadu	10,000 (-10,000)					
Punjab State Federation		6,000				6,000
Rajasthan State Federation		2,000				2,000
Private Trade	2,44,504	20,000	20,000	*		2,84,504
All Agencies	13,59,408 (-54,466)	67,000	25,000	30,000	5 Lakh Kg	14,26,942 a
Share of private trade in total Export Quota (%)	18.74	29.85	80.00			19.94

Note:

* It was to be allocated between CCI and private trade.

** It was to be allocated between CCI, private trade and State Federations.

a. Excluding 5 lakh Kgs of Hard Cotton Waste.

1. Figures in brackets with negative signs indicate quota cancelled/withdrawn/surrendered. It has therefore, been deducted in estimating total (net) quota released.

Annexure 3.3: Degree of State Intervention in Domestic Cotton Marketing

Particular	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87 (P)	1987-88 (P)	Average
Purchased by MSCMF	'000 bales	1278	1516	1763	786	1702	2920	1248	1200	1552
CCI	'000 bales	1179	1056	971	525	669	1574	823	646	930
Sub-total	'000 bales	2457	2572	2734	1311	2371	4494	2071	1846	2482
Production (Trade estimates)	'000 bales	7780	8400	8650	7516	10150	10700	9500	9000	8962
Share of MSCMF and CCI purchases in total production	%	31.58	30.62	31.61	17.44	23.36	42.00	21.80	20.51	27.69

Notes: MSCMF stands for Maharashtra State Co-operative Marketing Federation.
CCI stands for Cotton Corporation of India.

Source: 1. MSCMF
2. CCI
3. Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

ANNEX 3.4 DEGREE OF STATE INTERVENTION IN EXPORT MARKET OF COTTON, 1981-82 TO 1984-85

(thousand bales)

Exporting Agencies	1981-82	1982-83	1983-84	1984-85	Average
C.C.I.	46.42	273.60	113.67	80.73	128.60
MSCMF	256.07	339.14	159.62	68.05	205.72
GSCCF	47.41	17.45	21.40	18.88	26.28
APSCMF	-	-	-	0.82	0.20
Private Trade	15.74	34.55	59.33	11.00	30.15
Total	365.64	664.74	354.02	179.48	390.97
Share of CCI & MSCMF in Total Exports (%)	82.73	92.18	77.20	82.89	85.51

Notes CCI is Cotton Corporation of India; MSCMF is Maharashtra State Cooperative Marketing Federation; GSCCF is Gujarat State Cooperative Cotton Federation; APSCMF is Andhra Pradesh State Cooperative Marketing Federation.

Source: Indian Cotton Annual, different years, Director's Reports of the East India Cotton Association, Bombay.

Annex 3.5: REGIONAL DIMENSIONS OF COTTON PRODUCTION IN INDIA

State	Average 1983-84 to 1985-86 Production (Percentage share)	Area (Percentage share)	Yield (Kgs/Hec. weighted average	Compound Growth Rates 1967-68 to 1985-86 (%) Production	Yield	Irrigated area to total area under cotton (%) 1982-83
Maharashtra	16.73	35.81	79	1.77	1.68	4.7
Gujarat	21.69	18.45	200	0.57	1.62	30.9
Punjab	13.25	7.41	304	1.78	(-) 0.82	97.5
Karnataka	8.39	10.96	130	3.19	4.31	10.7
Andhra Pradesh	13.81	7.19	326	14.51	10.78	5.4
Haryana	7.39	4.62	272	3.82	0.48	97.5
Tamil Nadu	6.38	3.05	356	1.16	3.45	36.2
Madhya Pradesh	5.52	7.02	134	0.43	2.08	9.3
Rajasthan	5.93	4.78	211	5.80	3.17	90.7
Others	0.91	0.71	-	-	-	-
All India	100.00 (8212 th bales of 170 Kgs each)	100.00 (7561 th.hec)	185	2.56	2.54	29.5

Note: If we exclude 1983-84, which was an exceptionally bad year for Punjab cotton, Punjab would rank third in terms of production and first in terms of yield.

Source: Directorate of Economics and Statistics, Ministry of Agriculture.

Annex 3.6: CATEGORISATION OF DIFFERENT STAPLE LENGTH COTTONS: INTERNATIONAL AND INDIAN STANDARD DEFINITIONS

	International	Indian
1. Short staple	Below 13/16" (20.64 mm)	Below 19 mm
2. Medium staple	13/16" to 1" (20.64 mm to 25.4 mm)	20 mm to 21.5 mm
3. Medium long staple *	1 1/32" to 1 3/32" (26.19 mm to 27.78 mm)	22 mm to 24 mm
4. Long staple	1 1/8" to 1 5/16" (28.57 mm to 33.34 mm)	24.5 mm to 26 mm
5. Extra long staple **	Above 1 3/8" (34.92 mm)	Above 27 mm

Note:
* In India it is Superior Medium Staple
** In India it is Superior Long Staple

1. For international standards - Cotton: World Statistics, Bulletin of the International Cotton Advisory Committee, April 1985, Vol. 38, No. 7 (p.IV)

2. For Indian Standards - Indian Cotton Annual, 1982-83, East India Cotton Association Ltd., Bombay (p.157)

Annexure 3.7: Staplewise Production and Consumption of Cotton, 1980-81 to 1984-85

Staple Length	Staple Length (mm)	YEARS 1980-81	1981-82	1982-83	1983-84	1984-85	Average
1. Superior Long	27 mm & above						
Production		2.13	1.94	1.61	..38	2.69	1.95
Consumption		2.48	2.74	2.86	2.90	3.00	2.80
Excess		-0.35	-0.80	-1.25	-1.52	-0.31	-0.85
2. Long	24.5 mm to 26 mm						
Production		0.50	1.11	1.24	1.23	1.38	1.10
Consumption		0.92	0.68	0.66	0.80	0.80	0.77
Excess		-0.42	0.43	0.58	0.46	0.58	0.33
3. Superior Medium	22 mm to 24 mm						
Production		3.14	3.40	3.36	2.66	3.13	3.14
Consumption		1.49	1.21	1.44	1.40	1.46	1.40
Excess		1.65	2.19	1.92	1.26	1.67	1.74
4. Medium	20 mm to 21.5 mm						
Production		0.58	0.78	0.64	0.60	0.75	0.67
Consumption		2.47	2.16	2.34	2.60	2.40	2.39
Excess		-1.89	-1.38	-1.70	-2.00	-1.65	-1.72
5. Short	Below 19 mm						
Production		0.66	0.65	0.70	0.49	0.51	0.60
Consumption		0.30	0.33	0.26	0.39	0.40	0.34
Excess		0.36	0.54	0.44	0.10	0.11	0.26
6. Total							
Production		7.01	7.88	7.55	6.39	6.46	7.46
Consumption		7.68	7.12	7.56	8.09	8.66	7.86
Excess		-0.67	+ 0.76	-0.01	-1.70	-0.40	-0.40

Source: 1. For production, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.
2. For consumption (provisional). Directorate of Cotton Development.

Annexure 3.6: Cotton Production: Official and Trade Estimates (Million bales of 170 Kgs)

Cotton year	Official estimates	Trade estimates	Percentage difference
(1)	(2)	(3)	(4) = (3-2/2) 100
1980-81	7.01	7.78	10.98
1981-82	7.88	8.40	6.60
1982-83	7.55	6.65	14.57
1983-84	6.39	7.52	17.68
1984-85	8.46	10.15	19.98
1985-86	8.61	10.70	24.27
1986-87	7.01	9.50	35.52
Average	7.56	8.96	18.48

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Annexure 3.9: Maritime Freight Rates for Cotton

(US$/Quintal)

Years	US gulf to Japan	N.Europe	India
1980-81	15.91	20.00	22.27
1981-82	13.71	17.23	19.19
1982-83	8.72	10.97	12.21
1983-84	8.86	11.14	12.40
1984-85	8.86	11.14	12.40
1985-86	8.86	11.14	12.40
1986-87	7.48	9.41	10.47

Notes:

1. We have the actual freight rate for cotton bales from US to Japan and US to North Europe for 1983-84 (World Bank). These are projected for other years on the basis of freight rate index numbers compiled from freight rates for wheat (FAO Trade Year Book). Freight rate from US to India is assumed to be 1.4 times that from US to Japan. The freight rate from US to Japan is also assumed to be equal to that from India to Japan.

2. We have deliberately avoided the use of freight rates of Shipping Corporation of India because (i) they are well known to be much higher than international rates and (ii) it would distort comparability of estimates for other commodities (wheat and rice) where we have used international rates (of FAO).

Annexure 3.10 : Maharashtra: Processing, Marketing Costs and Trading Margins of Cotton (H-4 variety)

Particular	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Ex-Bombay price/a of H-4 lint (December-April)	Rs/q	1552.40b	1402.60b	1333.80c	1672.00c	1551.20c	1277.20c	1595.20c
2. Minus Sales Tax and Octroi @ 4% each	Rs/q	124.19	112.21	106.30	133.76	124.10	102.18	127.62
3. Net price of H-4 lint at Bombay (1-2)	Rs/q	1428.21	1290.39	1245.50	1538.24	1427.10	1175.02	1467.58
4. Price of Cotton-Seed sold by MSCMFd	Rs/q	212.64	219.31	212.61	278.98	223.42	204.84	288.00e
5. Value of 100 kgs of lint and 190.3 kgs of cotton-seed (assuming ginning & pressing loss of 1.32) (= 1.903 x Row 4 + Row 3)	Rs.	1832.86	1707.74	1650.10	2069.14	1852.27	1564.83	2015.64
6. Final price of H-4 Kapas (seed cotton) paid by MSCMF	Rs/q	553.33	464.07	550.09	606.90	496.97g	592.00h	540.00h
7. Pressing, marketing costs and trading margins in converting 294 kgs of kapas into lint and Cottonseed and selling at Bombay (Row 5 - Row 6 x 2.94)	Rs.	206.07	343.37	32.83	284.85	391.18	409.61i	428.04

Notes:

a. Ex-Bombay price is inclusive of (i) Central/State sales tax and (ii) Octroi payable at Bombay (see Indian Cotton Annual, 1985-86, p. 56).

b. Relate to H-4 of 30 mm staple length.

c. Relate to H-4 of 27 mm staple length due to non-availability of prices of the same staple length H-4 cotton for the entire period, except in 1986-87 where it is of 28 mm.

d. Derived price by dividing the value of cottonseed by the quantum of cottonseeds obtained by MSCMF (Source Indian Cotton Annual)

e. Relates to September to March (27th Annual Report and Accounts, All India Cottonseed Crusher's Association, p. 30).

f. The ginning ratio of 34% is taken from Indian Cotton Annual 1984-85, pp. 186-189, 192, 195; wastage of 1.3% is calculated from the detailed statements of MSCCGMF, averaged over 1980-81 to 1983-84. This is inclusive of the moisture loss.

g. This final price is lower than guaranteed price (Rs. 592/q), but still taken in this calculation because objective is to find out marketing and other associated expenses. In estimating MPC, however, we shall take guaranteed price because that is what the farmers receive in case final price is lower than guaranteed price.

h. Guaranteed prices due to lack of information on final prices.

i. taken the average of 1984-85 and 1986-87.

Annexure 3.11: Gujarat: Processing, Marketing Costs and Trading Margins of Cotton (S-4/6 variety)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Ex-Bombay price of S-4 lint (Superior) 31 mm (Dec-April)	Rs/q	1780.20	1569.00	1593.40	1841.20	1678.20	1519.40	1805.20
2. Sales tax and Octroi @ 4% each	Rs/q	142.42	125.52	126.67	147.30	134.26	121.55	144.42
3. Net price of S-4 lint at Bombay (1-2)	Rs/q	1637.78	1443.48	1456.73	1693.90	1543.94	1397.85	1660.78
4. Price of Cottonseed in Gujarat a	Rs/q	212.64	219.31	212.61	279.98	223.42	204.84	288.00
5. Value of 100 Kgs of lint and 190.3 Kgs of cottonseed (assuming ginning ratio of 34% and ginning & pressing loss of 1.3%) (= 1.903 x Row 4 + Row 3)	Rs	2042.43	1860.83	1861.33	2224.80	1969.11	1787.66	2209.84
6. Wholesale price of S-4 Kapas in Gujarat (Broach market) (Dec-April)	Rs/q	572.60	512.00	547.00	646.00	566.20	492.00	593.75
7. Processing, marketing costs and trading margins in coverting 294 Kgs of kapas into lint and cottonseed and selling at Bombay (Row 5 - Row 6 x 2.94)	Rs	358.99	355.55	253.15	325.56	304.48	341.18	463.22

Notes:

a: assumed to be the same as that in Maharashtra, due to absence of relevant information. For other relevant notes and references, see Annexure

Source: Reports of the Commission for Agricultural Costs & Prices (CACP) on Price Policy for Kharif Crops (different years), CACP, Ministry of Agriculture, Government of India.

Annexure 3.12: Punjab: Processing, Marketing Costs and Trading Margins of Cotton (J-34 variety)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Ex-Bombay price of J-34 lint (RG) (November-February)	Rs/q	1153.75	1309.00	1044.50	1336.50	1442.75	1097.25	1059.50
2. Sales tax and Octroi @ 4% each	Rs/q	92.30	104.72	83.56	106.92	115.42	87.78	84.76
3. Net price of J-34 lint (RG) (Row 1 - Row 2)	Rs/q	1061.45	1204.28	960.94	1229.58	1327.33	1009.47	974.74
4. Price of cottonseed in Punjab a	Rs/q	190.38	221.16	246.14	241.08	284.95	314.75	314.43
5. Value of 100 Kgs of lint and 190.3 Kgs of Cottonseed (assuming ginning ratio of 34% and ginning and pressing loss of 1.3%) (= 1.903 x Row 4 + Row 3)		1423.74	1625.15	1429.34	1688.35	1869.59	1608.44	1573.10
6. Wholesale price of J-34 kapas in Punjab (Bhatinda market) (November-February)	Rs/q	455.50	493.00	397.75	510.25	512.25	441.25	482.75
7. Processing, marketing costs and trading margins in converting 294 kgs of kapas into Lint and Cottonseed, and selling at Bombay (Row 5 - Row 6 x 2.94)	Rs	84.57	175.73	259.95	188.21	363.57	311.16	153.81

Notes:

a . These are calendar year averages (Source: Statistical Abstract of Punjab)

For other relevant notes and references, see Annexure

Annexure 3.13: Andhra Pradesh: Processing, Marketing Costs and Trading Margins of Cotton (MCU-5 variety)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	984-85	1985-86	1986-87
1. Ex-Bombay Price of MCU-5 lint (February-June)	Rs/q	1761.6	1546.4	1644.6	1844.2	1767.6	1638	2102.6
2. Sales tax and Octroi @ 4% each	Rs/q	140.93	123.71	131.57	147.54	141.41	131.04	168.21
3. Net Price of MCU-5 lint at Bombay (1-2)	Rs/q	1620.67	1422.69	1513.03	1696.66	1626.19	1506.96	1934.39
4. Price of Cottonseed in Andhra Pradesh/a	Rs/q	212.64	219.31	212.61	278.98	223.42	204.84	288.00
5. Value of 100 kgs of lint 190.3 kgs of Cottonseed (assuming ginning ratio of 34% and ginning and pressing loss of 1.3%) (= 1.903 * Row 4 + Row 3)	Rs.	2025.32	1840.04	1917.63	2227.56	2051.36	1896.77	2482.45
6. Wholesale price of MCU-5 kapas (February to June) (Tirpur Market)	Rs/q	630.20	590.00	645.00	695.75	635.00	608.00	899.00
7. Processing, marketing costs and trading margins in converting 294 kgs of kapas into lint and Cottonseed, and selling at Bombay (Row 5 - Row 6 * 2.94)	Rs.	172.53	105.44	21.33	182.05	184.46	109.25	-134.15/c

Notes:

/a. Assumed to be the same as in Maharashtra due to lack of relevant information.
/b. Available price quotation of MCU-5 variety is that of Tirpur market (Tamil Nadu) and is assumed same for Andhra Pradesh
/c. It indicates that in 1986-87 traders have incurred losses. For other relevant notes and references see Annexure.

Annexure 3.14: Estimation of reference prices (cif) of Cotton-seed at Bombay (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Cottonseed in US domestic market	$/ton	129.00	86.00	77.00	166.00	100.00	70.00	67.00 e
2. Fob expenses @ 3% of Row 1	$/ton	3.87	2.58	2.31	4.98	3.00	2.10	2.01
3. Maritime freight from US gulf to India	$/ton	61.94	53.38	33.97	34.50	34.50	34.50	29.13
4. Cif price of US cotton-seed at Bombay (1+2+3)	$/ton	194.81	141.96	113.28	205.48	137.50	106.60	98.14
5. Exchange Rate (Dec-April)	1$=Rs	8.15	9.22	9.90	10.70	12.52	12.25	12.91
6. Reference price (=cif price) of US Cotton-seed at Bombay (4 x 5/10)	Rs/q	158.77	130.89	112.15	219.86	172.15	130.58	126.70
7. Domestic price of cotton-seed in Maharashtra (MSCMF)	Rs/q	212.64	219.31	212.61	278.98	223.42	204.84	288.00
8. NPCs of cottonseeds (Row 7 / Row 6)		1.34	1.68	1.90	1.27	1.30	1.57	2.27

NOTES:

1. It is calculated as 1.15 times that of maritime freight for wheat (from US to India), FAO series, because (a) cotton-seed is lighter and more voluminous; (b) its shipments are less frequent and (c) these shipments are in smaller quantities.

Annexure 3.15: Estimation of Reference Prices (fob) of Cottonseed at Bombay (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Cottonseed in US domestic market	$/ton	129.00	86.00	77.00	166.00	100.00	70.00	67.00
2. Fob expenses @ 3% of Row 1	$/ton	3.87	2.58	2.31	4.98	3.00	2.10	2.01
3. Maritime freight from US gulf to Japan (= 1.15 times that for wheat FAO series)	$/ton	44.60	31.49	26.92	28.08	29.90	28.32	28.06
4. Insurance @ 1% of fob price	$/ton	1.33	0.88	0.79	1.71	1.03	0.72	0.69
5. Cif price of US Cottonseed in Japan (1+2+3+4)	$/ton	178.80	120.95	107.02	200.77	133.93	101.14	97.78
6. Minus freight and insurance from Japan to India (= that from US to Japan = 5-3-4) = fob price of cottonseed at Bombay	$/ton	132.87	88.58	79.31	170.98	103.00	72.10	69.01
7. Exchange Rate (Dec-April)	1$=Rs	8.15	9.22	9.90	10.70	12.52	12.25	12.91
8. Fob price of cottonseed at Bombay (Reference price)	Rs/q	108.29	81.67	78.52	182.95	128.96	88.32	89.09

Source: Same as in Annexure 14

Annexure 3.16: Maharashtra: Estimation of PNCs of Seed-cotton (Kapas), H-4 (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Mexican Cotton Lint (M-1 cif North Europe (December-April)	$/q	211.86	158.35	163.92	192.34	153.33	120.58	145.86
2. Minus freight from US to North Europe	$/q	20.00	17.23	10.97	11.14	11.14	11.14	9.41
3. Plus freight from US to India	$/q	22.27	19.19	12.21	12.40	12.40	12.40	10.47
4. Equals cif price in Bombay (December-April)	$/q	214.13	160.31	165.16	193.60	154.59	121.84	146.92
5. Exchange Rate (December-April)	1$-Rs	8.15	9.22	9.90	10.70	12.52	12.25	12.91
6. Cif Price of Mexican cotton lint in Bombay (4x5) (December-April)	Rs/q	1745.16	1478.06	1635.08	2071.52	1935.47	1492.54	1896.74
7. Cif price of 190.3 kgs of cotton-seed at Bombay (see Annexure 14)	Rs/kgs	302.14	249.08	213.42	418.39	327.60	248.49	241.11
8. Cif price of 100 kgs of Mexican lint and 190.3 kgs of imported cottonseed (6+7)	Rs	2047.30	1727.14	1848.50	2489.91	2263.07	1741.03	2137.85
9. Minus Processing, Marketing costs and trading margins for 294 kgs of Kapas in terms of lint and seed (See Annexure 10)	Rs/294kgs	206.07	343.37	32.83	284.85	391.18	409.61	428.04
10. Equals value of 294 kgs of Mexican kapas in Maharashtra (8-9) (reference price)	Rs/294kgs	1841.23	1383.77	1815.67	2205.06	1871.89	1331.42	1709.81
11. Final Price paid by MSCMF to farmers	Rs/q	553.33	464.07	550.09	606.9	592.00$ (496.97)	592$	540$
12. PNCs of H-4 seed-cotton (kapas row 11 x 2.94/Row 10)		0.88	0.99	0.89	0.81	0.93 (0.78)	1.31	0.93

Note: $ Guaranteed Price. Figure in parenthesis is the final price. It may be noted that in cases where final price is lower than guaranteed price, farmer gets guaranteed price and the loss is met by MSCMF.

Source: 1. Cotton World Statistics, International Cotton Advisory Committee, Washington (Various issues) (for cif price of Mexican cotton).
2. FAO and World Bank data for maritime freight rates (Annexure 9).
3. RBI Bulletin (Monthly) for exchange Rates.
4. Indian Cotton Annual, the East India Cotton Association, Bombay (for working out processing, marketing costs and trading margins see Annexure 10).

Annexure 3.17: Gujarat: Estimation of NPCs of Seed-Cotton (Kapas), Shankar-4 (Superior) Variety (Importable Hypothesis)

Particular	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of California cotton lint (SM 1 1/8") cif, North Europe (December-April)	$/q	226.30	170.02	186.69	212.26	168.52	133.52	171.82
2. Minus freight from US to North Europe	$/q	20.00	17.23	10.97	11.14	11.14	11.14	9.41
3. Plus freight from US to India	$/q	22.27	19.19	12.21	12.40	12.40	12.40	10.47
4. Equals cif price in Bombay (December-April)	$/q	228.57	171.98	187.93	213.52	169.78	134.68	172.88
5. Exchange Rate (December-April)	1$=Rs	8.15	9.22	9.90	10.70	12.52	12.25	12.91
6. Cif price of California Cotton lint in Bombay (4x5)	Rs/q	1862.84	1585.66	1860.51	2284.66	2125.65	1649.83	2231.88
7. Cif price of 190.3 kgs of Cottonseed at Bombay (see Annexure 14)	Rs/190.3 kgs	302.14	249.08	213.42	418.39	327.60	248.49	241.11
8. Cif price of 100 kgs of California Cotton lint and 190.3 kgs of imported cottonseed (6+7)	Rs	2164.98	1834.74	2073.93	2703.05	2453.25	1898.32	2472.99
9. Minus Processing, Marketing Costs and Trading Margins for 294 kgs of Kapas in terms of lint and seed (see Annexure 11)	Rs/294 kgs	358.99	355.55	253.15	325.56	304.48	341.18	463.22
10. Equals value of 294 kgs of California Kapas in Gujarat (8-9) (Reference price)	Rs/294 kgs	1805.99	1479.19	1820.78	2377.49	2148.77	1557.14	2009.77
11. Wholesale price of Shankar-4 seed-	Rs/q	572.60	512.00	547.00	646.00	566.20	492.00	592.75
12. NPCs of Shankar-4 seed-cotton (kapas) (Row 11 x 2.94/Row 10)	Rs/q	0.93	1.02	0.88	0.80	0.77	0.93	0.87

Source: 1. Same as in Annexure 16.
2. Reports of the CACP on the Price Policy of Kharif Crops, different years, CACP, Ministry of Agriculture, Government of India.

Annexure 3.18: Punjab : Estimation of NPCs of Seed-Cotton (kapas) J-34 variety (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Orleans/Texas (1") Cotton lint, cif North Europe (November-February)	$/q	204.3	140.04	144.03	173.55	146.45	136.91	124.59
2. Minus freight from US to North Europe	$/q	20	17.23	10.97	11.14	11.14	11.14	9.41
3. Plus freight from US to India	$/q	22.27	19.19	12.21	12.4	12.4	12.4	10.47
4. Equals cif price in Bombay (November-February)	$/q	206.57	142	145.27	174.81	147.71	138.17	125.65
5. Exchange Rate (November-February)	1$=Rs	8.01	9.14	9.6	10.56	12.52	12.16	13.04
6. Cif price of Orleans/Texas cotton lint in Bombay (485) (Nov-Feb)	Rs/q	1654.62	1297.88		1845.99	1849.33	1680.15	1638.48
7. Cif price of 190.3 kgs of cotton-seed at Bombay (see Annexure 14)	Rs/190.3 kgs	302.14	249.08	213.42	418.39	327.6	248.49	241.11
8. Cif price of 100 kgs of Orleans/ Texas cotton lint and 190.3 kgs of imported cottonseed (6+7)	Rs	1956.76	1546.96	1637.07	2264.38	2176.93	1928.64	1879.59
9. Minus Processing, Marketing costs and trading margins for 294 kgs of kapas in terms of lint and seed (See Annexure 12)	Rs/294 kgs	84.57	175.73	259.95	188.21	363.57	311.16	153.81
10. Equals reference price of 294 kgs of Orleans/Texas kapas in Punjab (8-9) (reference price)	Rs/294 kgs	1872.19	1371.23	1377.12	2076.17	1813.36	1617.48	1725.98
11. Wholesale price of J-34 seed-cotton (kapas) in Bhatinda (Punjab) (November-February)	Rs/q	455.5	493	397.75	510.25	512.25	441.25	482.75
12. NPC of Orleans/Texas seed-cotton (kapas) (Row 11 * 2.94/Row 10)		0.71	1.06	0.85	0.72	0.83	0.8	0.82

Source: Same as in Annexure 17.

Annexure 3.19: Andhra Pradesh: Estimation of NPCs of Seed-Cotton (kapas), MCU-5 variety (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1987-87
1. Price of Giza 67/69/81 cotton lint cif North Europe (February-June)	$/q	304.52	239.00	246.63	304.21	296.97	245.75	247.53
2. Plus the difference in freight from North Africa to N. Europe to India (provisional)	$/q	3.59	3.09	1.97	2.00	2.00	2.00	1.80
3. Equals cif price in Bombay	$/q	308.11	242.09	248.60	306.21	298.97	247.75	249.33
4. Exchange Rate (February-June)	1$=Rs	8.38	9.36	10.00	10.89	12.49	12.43	12.84
5. Cif price of Giza 67/69/81 cotton lint at Bombay (Feb-June) (3x4)	Rs/q	2581.96	2265.96	2486.00	3334.63	3734.13	3079.53	3201.40
6. Cif price of Giza 67/69/81 cotton at Bombay (see Annexure 14)	Rs/190.3 kgs	302.14	249.08	213.42	418.39	327.60	248.49	241.11
7. Cif price of 100 kgs of Giza 67/69/81 cotton lint and 190.3 kgs of imported cottonseed (5+6)	Rs	2884.10	2515.04	2699.42	3753.02	4061.73	3328.02	3442.51
8. Minus Processing, Marketing costs and trading margins for 294 kgs of Kapas in terms of lint and seed (see Annexure 13)	Rs/294 kgs	172.53	105.44	21.53	182.65	184.46	109.25	-134.15
9. Equals value of 294 kgs of Giza 67/69/81 kapas in Andhra Pradesh [illegible]-8) (Reference price)	Rs/294 kgs	630.20	590.00	645.00	695.75	635.00	608.00	890.00
10. Wholesale price of MCU-5 seed-cotton (Kapas) in Tripur (TN), (assumed to be the same as (AP). (Feb-June)	Rs/q	630.20	590.00	645.00	695.75	635.00	608.00	890.00
11. NPCs of MCU-5 seed-cotton (kapas) (Row 10x2.94/Row 9)		0.68	0.72	0.72	0.57	0.48	0.55	0.73

Annexure 3.21: Maharasntra: Estimation of NCs of Seed-Cotton (kapas) H-4 Variety (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Mexican cotton lint, cif North Europe (Dec-April)	$/q	211.86	158.33	163.92	192.34	153.33	120.58	145.86
2. Minus freight from US to North Europe	$/q	20.00	17.23	10.97	11.14	11.14	11.14	9.41
3. Plus freight from US to Japan	$/q	15.91	13.71	8.72	8.86	8.86	8.86	7.48
4. Minus freight and insurance from Japan to Bombay. *	$/q	18.03	15.29	10.36	10.78	10.35	10.07	8.94
5. Equals fob price of Mexican cotton lint at Bombay	$/q	189.74	139.54	151.31	179.28	140.66	108.23	134.99
6. Exchange Rate (December-April)	1$=Rs	8.15	9.22	9.90	10.70	12.52	12.25	12.91
7. Fob price of Mexican cotton lint at Bombay (5x6)	Rs/q	1546.38	1286.56	1497.97	1918.30	1761.06	1325.82	1742.72
8. Fob price of Cottonseed (190.3 Kgs) (see Annexure 15)	Rs/190.3 Kgs	206.08	155.42	149.42	348.15	245.41	168.07	169.54
9. Fob price of 100 Kgs of Mexican cotton lint and 190.3 Kgs of cottonseed (7+8)	Rs	1752.46	1441.98	1647.39	2266.45	2006.47	1493.89	1912.26
10. Minus processing, marketing costs and trading margins for 294 Kgs of ginned in terms of lint and seeds (see Annexure 10)	Rs/294 kgs	206.07	343.37	32.83	284.85	391.18	409.61	428.04
11. Equals reference price for exportable seed-cotton (H-4) in Maharasntra (Row 9 - Row 10)/1.94	Rs/q	525.98	373.68	549.17	674.01	549.42	368.80	504.84
12. Final Price paid by MSCMF to farmers for H-4 variety of kapas	Rs/q	553.33	464.07	550.09	600.90	592.00# (496.97)	592.00#	549.00#
13. NRCs of H-4 seed-cotton (kapas) (Row 12/Row 11)		1.05	1.24	1.00	0.90	1.08 (0.99)	1.60	1.07

Notes:
1. Freight from Japan to Bombay is assumed to be the same as from US to Japan.
   Insurance is estimated @ 1% of the cif North Europe price of cotton lint.

Guaranteed price.

Source: Same as in Annexure 1a.

Annexure 3.22: Gujarat: Estimation of NPCs of Seed-Cotton (kapas), Shankar-4 (Superior) Variety (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of California cotton lint (SM 1 1/8" c.f. North Europe (December-April)	$/q	226.30	170.02	186.69	212.26	168.52	133.42	171.82
2. Minus freight from US to North Europe plus freight from US to Japan minus freight and insurance from Japan to Bombay	$/q	-22.12	-18.81	-12.61	-13.06	-12.67	-12.35	-10.87
3. Equals fob price of California cotton lint at Bombay	$/q	204.18	151.21	174.08	199.20	155.85	121.07	160.95
4. Exchange Rate (December-Ap ..)	1$=Rs	8.15	9.22	9.90	10.70	12.52	12.25	12.91
5. Fob price of California cotton lint at Bombay (3*4)	Rs/q	1664.07	1394.16	1723.39	2131.44	1951.24	1483.11	2077.86
6. Fob price of cottonseed (190.3 kgs) (see Annexure 15)	Rs/190.3 kgs	206.08	155.42	149.42	384.15	245.41	168.07	169.54
7. Fob price of 100 kgs of California cotton lint and 190.3 kgs of cotton seed (5+6)	Rs	1870.15	1549.58	1872.81	2479.59	2196.65	1651.18	2247.40
8. Minus processing, marketing costs and trading margins from 294 kgs of kapas in terms of lint and seeds (see Annexure 11)	Rs/294 kgs	358.99	355.55	253.15	325.5o	304.48	341.18	463.22
9. Equals reference price for exportable seed-cotton (Shankar-4 Superior) in Gujarat (Row - Row 8)/2.94	Rs/q	514.00	406.13	550.90	732.66	643.59	465.58	606.86
10. Wholesale price of Shankar-4 seed-cotton (kapas) at Broach (Gujarat) (December-April)	Rs/q	572.60	512.00	547.00	646.00	566.20	492.00	593.75
11. NPCs of Shankar-4 Seed-Cotton (kapas) (Row 10/Row 9)		.11	1.2c	1.99	0.88	0.88	1.10	0.96

Notes: 1. See Annexure 21, Footnote 1.
Source: Same as in Annexure 17.

Annexure 3.23: Punjab: Estimation of NPCs of Seed-Cotton (kapas) J-34 variety (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Orleans/Texas (1") cotton lint, c.i.f. North Europe (November-February)	$/q	204.30	140.04	144.03	173.55	146.45	136.91	124.59
2. Minus freight from US to North Europe Plus freight from US to Janan Minus freight and insurance from Japan to Bombay/1	$/q	-22.12	-18.81	-12.61	-15.06	-12.67	-12.55	-10.87
3. Equals fob price of Orleans/Texas cotton lint at Bombay	$/q	182.18	121.23	131.42	160.49	133.78	124.36	113.72
4. Exchange Rate (November-February)	1$=Rs	8.01	9.14	9.80	10.56	12.52	12.16	13.04
5. fob price of Orelans/Texas cotton lint at Bombay (3x4)	Rs/q	1459.26	1108.04	1287.92	1694.77	1674.93	1514.65	1482.91
6. fob price of cottonseed (190.3 kgs) (see Annexure 15)	Rs/190.3 kgs	206.08	155.42	149.42	348.15	245.41	168.07	169.54
7. fob price of 100 kgs of Orleans/ Texas cotton lint and 190.3 kgs of cottonseed (5+6)	Rs	1665.34	1263.46	1437.34	2042.92	1920.34	1682.72	1652.45
8. Minus processing, marketing costs trading margins for 294 kgs of kapas in terms of lint and seed (see Annexure 12)	Rs/294 kgs	84.57	175.73	259.95	188.21	363.57	311.16	153.81
9. Equals reference price of exportable seed-cotton (J-34) in Punjab (Row 7 - Row 8)/2.94	Rs/q	537.68	369.98	406.06	630.85	525.51	466.52	508.74
10. Wholesale price of J-34 seedcotton (kapas) in Bhatinda (Punjab) (November-February)	Rs/q	455.50	493.00	397.75	510.25	512.25	441.25	482.75
11. NPCs of Orlean/Texas seed-cotton (kapas) (Row 10/Row9)		0.85	1.33	0.99	0.81	0.97	0.95	0.95

Notes: 1. See Annexure 21, footnote 1.
Source: Same as in Annexure 18.

Annexure 3.24: Andhra Pradesh: Estimation of NPCs of Seed-cotton (Kapas), MCU-5 variety (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Price of Giza 67/69/81 cotton lint cif North Europe (Feb-June)	$/q	304.52	239.00	246.60	304.21	296.97	245.75	247.53
2. Plus the difference in freight rate from North Africa to Japan and from North Africa to North Europe (Provisional)	$/q	14.36	12.38	7.88	8.00	8.00	8.00	6.75
3. Minus freight and insurance from Japan to Bombay	$/q	18.95	16.10	11.19	11.90	11.83	11.32	9.95
4. Equals fob price of Giza 67/69/81 lint at Bombay (Feb-June)	$/q	299.93	235.28	243.32	300.31	293.14	242.43	244.33
5. Exchange Rate (Feb-June)	1$=Rs	8.38	9.36	10.00	10.89	12.49	12.43	12.84
6. fob price of cottonseed (190.3 kgs) lint at Bombay (4x5)	Rs/q	2513.41	2202.22	2433.20	3270.38	3661.32	3013.40	3137.20
7. fob price of cotton seed (190.3 kgs) (see annexure 15)	Rs/190.3 kgs	206.08	155.42	149.42	348.15	245.15	168.07	169.54
8. fob price of 100 kgs of cotton lint and 190.3 kgs of cottonseed (6+7)	Rs	2719.49	2357.64	2582.62	3618.53	3906.73	3181.47	3306.74
9. Minus processing, marketing costs and trading margins for 294 kgs of kapas in terms of lint and seeds (see Annexure 13)	Rs/294 kgs	172.53	105.44	21.33	182.46	184.46	109.25	134.15
10. Equals reference price for exportable seed-cotton (MCU-5) in Andhra Pradesh (Row 8 - Row 9)/2.94	Rs/q	866.31	766.05	871.19	1168.87	1266.08	1044.97	1170.37
11. Wholesale price of MCU-5 Seed-cotton (Kapas) in Tripur (TN) (assumed to be the same in AP), (February-June)	Rs/q	630.20	590.00	645.00	695.75	625.00	608.00	890.00
12. NPCs of MCU-5 seed-cotton (Kapas) (Row 11/Row 10)		0.73	0.77	0.74	0.59	0.50	0.58	0.76

Notes: 1. See Annexure 21, footnote 1.
Source: Same as in Annexure 19.

Annexure 3.25: INPUT STRUCTURE OF INDIAN COTTON (Percentage)

Cost Item	Maharashtra 1 (H-4)	Gujarat 1 (S-4/6)	Punjab 1 (J-34/320F)	Andhra Pradesh 1 (MCU-5)
Operational Cost	60.04		61.75	62.76
Human labour	28.20	14.72	29.17	12.00
Bullock labour	12.53	22.06	5.19	3.01
Machine labour	0.04	0.02	7.16	0.98
Seed	4.12	2.66	1.73	3.14
Fertiliser	9.24	11.95	7.19	11.66
	13.79			17.40
Manure	4.55	5.85	0.48	5.74
Insecticides	2.75	20.67	5.81	22.35
Irrigation charges	0.04	8.40	3.66	2.04
Interest on working capital	1.57	7.19	1.35	1.85
Fixed Cost	39.96		38.24	37.24
Rental value of owned land	29.83	21.22	23.21	31.70
Rent paid for leased in land	-	-	3.43	-
Land revenue, cesses, taxes, etc.	1.13	-	0.48	0.66
Dep. on implements & farm buildings	2.85	-	2.35	1.32
Interest on fixed capital	6.13	-	8.47	3.56
Total cost	100.00	100.00	100.00	100.00
(Rs/hectare)	989.01	6569.00	3380.91	6104.93
Yield/hectare (Kgs)	Nil	1139.00	706.00	1221.00
Total cost (Rs/hectare) estimated for triennium average (1981-82 to 83-84	1350.02	9196.60	3380.91	8286.03
Average yield (Kgs/hectare) for triennium (1981-82 to 83-84)	432.13	1274.72	706.00	2265.00

Notes:

1. The cost structure of H-4 in Maharashtra relates to an average of two years - 1976-77 and 1977-78; of Shankar 4/5 in Gujarat relates to three yearly average of 1974-75 to 1976-77; of J-34/320F in Punjab to three yearly average of 1981-82 to 1983-84 and of MCU-5 in Andhra Pradesh to three yearly average of 1975-76 to 1977-78.

2. For Maharashtra and Andhra Pradesh, fertiliser and manure appears as a combined figure. They are separated in the ratio of 67:33, which prevails for Gujarat.

3. The estimates are constructed on the basis of increases in the relevant input price indices. For Maharashtra and Andhra Pradesh, it is from 1976-77 onwards. The new cost estimates are 1.36 times the old ones. For Gujarat it is from 1975-76 onwards and we have multiplied the mid-seventies total cost of Rs.6569 by 1.4 times to get total cost for 1981-82 to 1983-84.

4. Yields have been projected for these specific varieties for the 1980s by applying the statewise rates of growth in the overall yield of cotton (of all varieties) during the period 1967-68 to 1985-86. These growth rates are Gujarat 1.62%, Maharashtra 1.08% and Andhra Pradesh 10.78%. For Punjab it is the actual yield for 'cotton' which is approximated for J-34/320F variety.

(contd.)

as given in cost of cultivation data.

5. It is allocated between human, bullock and machine labour in the same ratio which exists for Maharashtra.

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India.

Annexure 3.26: NPCs of Tradeable Inputs of Seed-Cotton (Kapas)

State/Year	Farm Machinery (Tractors)	Fertilisers (NPK)	Seeds	Insecticides	All tradeable Inputs
Maharashtra					
1980-81	1.26	0.77	1.34	2.7	1.24
1981-82	1.26	0.82	1.68	2.7	1.38
1982-83	1.26	0.97	1.90	2.7	1.50
1983-84	1.26	0.89	1.27	2.7	1.29
1984-85	1.26	0.72	1.30	2.7	1.20
1985-86	1.26	0.69	1.57	2.7	1.26
1986-87	1.26	0.91	2.27	2.7	1.56
Average	1.26	0.82	1.62	2.7	1.34
Weights (Av. 1981-82 to 83-84)	0.02	5.34	2.38	1.59	9.34
Gujarat					
1980-81	1.26	0.77	1.34	2.7	1.94
1981-82	1.26	0.82	1.68	2.7	1.95
1982-83	1.26	0.97	1.90	2.7	2.05
1983-84	1.26	0.89	1.27	2.7	1.98
1984-85	1.26	0.72	1.30	2.7	1.92
1985-86	1.26	0.69	1.57	2.7	1.93
1986-87	1.26	0.91	2.27	2.7	2.06
Average	1.26	0.82	1.62	2.7	1.98
Weights (Av. 1981-82 to 83-84)	0.03	15.19	3.38	26.27	44.86
Punjab					
1980-81	1.26	0.77	1.34	2.7	1.49
1981-82	1.26	0.82	1.68	2.7	1.53
1982-83	1.26	0.97	1.90	2.7	1.60
1983-84	1.26	0.89	1.27	2.7	1.52
1984-85	1.26	0.72	1.30	2.7	1.47
1985-86	1.26	0.69	1.57	2.7	1.48
1986-87	1.26	0.91	2.27	2.7	1.61
Average	1.26	0.82	1.62	2.7	1.53
Weights (Av. 1981-82 to 83-84)	7.34	7.37	1.77	5.96	22.45
Andhra Pradesh					
1980-81	1.26	0.77	1.34	2.7	1.56
1981-82	1.26	0.82	1.68	2.7	2.00
1982-83	1.26	0.97	1.90	2.7	1.07
1983-84	1.26	0.89	1.27	2.7	1.99
1984-85	1.26	0.72	1.30	2.7	1.94
1985-86	1.26	0.69	1.57	2.7	1.95
1986-87	1.26	0.91	2.27	2.7	2.08
Average	1.26	0.82	1.62	2.7	2.00
Weights (Av. 1981-82 to 83-84)	0.56	6.64	1.79	12.72	21.71

(contd.)

Four States Combined					
1980-81	1.26	0.77	1.34	2.7	1.78
1981-82	1.26	0.82	1.62	2.7	1.83
1982-83	1.26	0.97	1.90	2.7	1.90
1983-84	1.26	0.89	1.27	2.7	1.81
1984-85	1.26	0.72	1.30	2.7	1.75
1985-86	1.26	0.69	1.57	2.7	1.77
1986-87	1.26	0.91	2.27	2.7	1.91
Average	1.26	0.82	1.62	2.7	1.82
Weights	7.95	34.62	9.34	46.68	98.59
(Av. 1981-82 to 83-84)					

Annexure 3.27: ESTIMATION OF WEIGHTS FOR TRADEABLE INPUTS (TRIENNIUM AVERAGE OF 1981-82 TO 1983-84)

	Maharashtra	Gujarat	Punjab	Andhra Pradesh
1. Value of fertiliser used (Rs/hectare)	124.74	1098.99	243.09	967.67
2. Value of Seed used (Rs/hectare)	56.62	244.63	58.59	260.59
3. Value of farm machinery used (Rs/hectare)	0.54	1.84	242.07	81.33
4. Value of insecticides used (Rs/hectare)	37.13	1900.94	196.43	1854.83
5. Value of all tradeable inputs used (Row 1 to Row 4) (Rs/hectare)	218.03	3246.4	740.08	3164.1e
6. Three yearly average yield of the relevant seed cottpn (kapas) variety* (q/hec)	4.32	12.74	7.06	22.65
7. Three yearly average price of the relevant seed cotton (kapas) variety** (Rs/q)	540.35	568.00	467.00	643.58
8. Value weights for fertilisers (Row 1/Row 6) x Row 7	5.34	15.19	7.37	6.64
9. Value weights for seeds (Row 2/Row 6) x Row 7	2.38	3.38	1.77	1.79
10. Value weights for farm machinery (Row 3/Row 6) x Row 7	0.02	0.03	7.34	0.56
11. Value weights for insecticides (Row 4/Row 6) x Row 7	1.59	26.27	5.96	12.72
12. Value weights for all tradeable inputs (Row 5/Row 6) x Row 7	9.34	44.86	22.45	21.71

Notes: * See Annexure 25.
** See Annexures 16 to 19.

Annexure 3.22: Projected Variety Specific Yields of Seed-Cotton (kapas) in India, Selected States

States	Variety	YEARS						
		1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Maharashtra	Hybrid-4	417.95	424.97	432.11	439.36	446.74	454.23	461.86
2. Gujarat	Shankar-4/6	1254.29	1254.29	1274.61	1295.26	1316.24	1337.56	1359.23
3. Punjab	J-34/320F	908.82	929.41	841.18	544.12	1314.71	1255.88	1491.18
4. Andhra Pradesh	MCU-5	1839.00	2037.00	2257.00	2500.00	2769.00	3067.50	3398.18

Notes:
These are projected yields. For Maharashtra, projection is made by applying 1.68% rate of growth (compound) to the yield level of 391 kgs/hec. in 1976-77 as reported in cost data. For Gujarat base year yield is 1139 kgs/hec. in 1975-76 and the rate of growth is 1.62% p.a. For Punjab, yield levels are taken from Estimates of Area and Production of Principal Crops in India, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. Since J-34/320F is the predominant cotton variety in Punjab, use of cotton yields (pertaining to all varieties) in Punjab would not affect our results significantly. For Andhra Pradesh, base year yield for 1976-77 is 1221 Kgs/hec. and the rate of growth is 10.78% p.a. The rates of growth are the ones which prevailed in different states (for all varieties of cotton combined) during 1967-68 to 1985-86.

CHAPTER 4

INDIA: EFFECTIVE INCENTIVES FOR AGRICULTURE THE CASE OF GROUNDNUT

Introduction

4.01 Oilseeds production represents about 7.5 per cent of the total value of crop output in India. Increasing demand for edible oils, growing at the rate of about 3.5 to 4 per cent per annum coupled with eratic supply of oilseeds, has resulted in mounting imports. More than one-third of edible oil consumption is being imported with the import bill touching Rs. 10 billion in the drought year 1987-88. The widening demand-supply imbalance in edible oils has evoked a growing concern in the Government regardomg the oilseeds economy. Consequently, the National Oilseeds Development Project (NODP) was initiated in 1984-85; the National Agricultural Cooperative Marketing Federation (NAFED) was designated as the nodal agency for undertaking price support operations in respect of oilseeds for a period of five years beginning 1985-86 season; the Technology Mission on Oilseeds comprising of four micro-missions was launched in 1986.[1] In 1989 a buffer stock/price support scheme was undertaken, using the National Dairy Development Board as the executing agency.

4.02 Against this background it is important to explore the structure of effective incentives as it has prevailed in the oilseeds economy of India during 1980s, and the shape it is likely to take with increasing Government intervention in this sector. Groundnut - the predominant crop of Indian oilseeds crop-complex -- is selected for this purpose. Trends in the groundnut economy are often transmitted to other oilseed crops. Exploring the structure of effective incentives in the groundnut economy is, therefore, indicative of the structure of entire oilseeds economy. Incentives to groundnut cultivators are measured by following the standard methodology described in chapter 1 and estimating the standard set of Nominal Protection Coefficients (NPCs), Effective Projection Coefficients (EPCs) and Effective Subsidy Coefficients (ESCs).[2]

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[1] The Technology Mission on Oilseeds seeks to achieve self-reliance in edible oils by 1990 by raising oilseeds production to 18 million tonnes by 1989-90 and 26 million tonnes by 2000 AD. The strategy to achieve this ambitious target involves four micro missions (i) crop technology, for developing new seeds/varieties that are better in terms of yield, pest resistence, aflatoxin, etc. Included here is the objective of substitution of groundnut by sunflower, especially in Gujarat. (ii) post harvest technology to modernise processing and storage so that oil recovery can be increased; (iii) farmers' support system for propagation of new interventions/innovations through extension services; (iv) price, storage, processing, and marketing, which would aim at providing remunerative prices to farmers (see Technology Mission on Oilseeds, Department of Agricultural Research and Education, Ministry of Agriculture, Government of India, January 1987 and the associated Reports on the four micro-missions.

[2] See also Garry Pursell and Neil Roger: and Pasquale L. Scandizzo and Colin Bruce.

4.03 The results suggest that groundnut cultivators in India have been highly protected on balance. For example, calculations including subsidies (ESCs) suggest that on average in the 1980s domestic resources received in groundnut protection received 71% protection (ESC=1.71). This compares with an estimate of 40% average effective protection for manufacturing (World Bank, 1987) and disprotection for cotton, rice, wheat. Given short-term and long-term projections of world prices of groundnut (oil and meals), which are likely to remain depressed at around 1986 levels, it appears that the degree of "protection" will remain very high for Indian groundnut cultivators (the ESC is likely to remain greater than 2) in the coming years. Even if one adjusts for a premium of 25% on foreign exchange and estimates "adjusted" ECs, which would be very close to cost benefit indicators such as Domestic Resource Cost (DRC), the result is similar. This result when viewed from either the standpoint of earning and saving foreign exchange or from the standpoint of comparative advantage, indicates that groundnut is neither an efficient import substitute nor an efficient exportable commodity. It also suggests that programs to expand production of groundnut are likely to yield low economic rates of return. This is particularly true in areas where groundnuts compete for resources with cotton, rice and wheat, such as Gujarat. All of these commodities are efficient import substitutes, or even exports. Hence, substitution of groundnuts for these crops could even result in a net loss of foreign exchange.

4.04 Section I of this Chapter provides a brief sketch of the groundnut economy. Section II estimates NPCs of groundnut while Section III calculates NPCs of tradeable inputs and the corresponding EPCs Section IV is devoted to the estimation of ESCs of groundnut. Finally, Section V contains some concluding observations based on the results derived in preceding sections.

A. The Groundnut Economy: A Brief Sketch

4.05 India is by far the largest producer of groundnuts in the world (33.57%), followed by China (22.27%) and the USA (8.73%).[3] West Africa, which was traditionally an important groundnut producing region, witnessed significant cut-backs in output, primarily because of repeated droughts and diseases, as well as other factors including domestic price policies that did not allow farmers to obtain the full benefit of world prices.[4]

4.06 Groundnut is mainly traded internationally in the form of oil and meal, with a very small proportion taking the form of groundnut kernels. The major market for groundnut (oil) remains Europe, particularly France,

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[3] Average of 1982 to 1984, FAO Production Year Book, 1984.

[4] Price Prospects for Major Primary Commodities, Vol. II, World Bank, 1984 (p. 219).

Italy, Federal Republic of Germany, Belgium, Netherlands and the United Kingdom, which together account for about 90 per cent of world imports of groundnut (oil).[5]

4.07 In the 1970s India was an exporter of handpicked, select (HPS) groundnuts to European countries and the USSR. (See Annexure 1 for figures on HPS groundnut exports during 1974-75 to 1985-86.) Exports of HPS groundnut were canalized in November 1974 through an agency of private traders - The Indian Oil and Produce Exporters Association (IOPEA). During the mid-1970s, groundnut exports reached as much as 113 thousand tonnes in 1975-76 and 123 thousand tonnes in 1976-77. About 80 per cent of these exports were to hard currency areas and only 20 per cent to rupee payment countries of eastern Europe and the USSR. In 1977-78, however, the Government of India banned the exports of HPS groundnuts and from 1978-79 (w.e.f. December 29, 1978) onwards, its exports were canalized through an apex cooperative marketing agency - National Agricultural Cooperative Marketing Federation of India Limited (NAFED). Exports were to take place in accordance with the export-quota released by Government (Ministry of Commerce) from time to time. This measure began a regime of much greater regulation of HPS groundnut exports. Also, during the next few years exports fell sharply and became heavily skewed in favour of the rupee payment area. For example, in 1981-82, the entire export of HPS groundnut went to the USSR.

4.08 In an effort to revive HPS Groundnut exports to the hard currency area, and perhaps also to give an opportunity to private traders, who held NAFED solely responsible for this dismal performance,[6] the Government allowed private trade and cooperatives to participate in exports from 1982-83 onwards. But nothing substantial came out of this change of policy, primarily due to unfavourable price ratios at home and in the international market. During 1983-84 and 1984-85 the export-quotas fixed for different agencies were as follows: NAFED - 27,500 tonnes; Grofed: 10,000 tonnes and private trade: 72,500 tonnnes. It should, however, be noted that private traders were allowed to export only as associate shippers on first-cum-first served basis against contracts backed by 100 per cent irrevocable letters of credit to be registered with NAFED.[7]

4.09 The emergence of such a relatively restrictive export policy regime was in fact one response to a growing deficit of edible oils at home. Since the Government limited edible oil imports, this gradually pushed the domestic price of groundnut upward. At the same time, exports of groundnut began to fall much below even the export targets (quota). For example, during 1980-81 to 1984-85, on average, the actual exports of HPS groundnut from India (mostly to the rupee trading area) were only 32,000, tonnes as against an export target (quota) of about 85,000 tonnes.

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[5] Op. cit. p. 220.

[6] For greater details of this dispute, see S. Ganguly (1982-83): "The NAFED-IPPEA Confrontation", Business World, December 20, 1982 to January 2, 1983.

[7] NAFED (1986): Groundnut, Commodity Bulletin, p. 35.

4.10 Other factors also played a role in the substantial fall in exports compared to mid-1970s. China emerged as an aggressive seller in the world market of HPS groundnuts after 1980-81, making it harder for India to compete on the price front. Another important factor in the sudden decline in India's exports of HPS groundnut was the presence of high degree of aflatoxin.[8] Importing countries such as the UK, Germany, Japan, Yugoslavia, Netherlands, Switzerland etc. insisted on aflatoxin - free delivery of HPS groundnut. India was not able to fulfil this requirement as aflatoxin could develop in its exports at various stages, including the sea voyage. In consequence, India's share in world groundnut exports slid from 12.8 per cent during the mid-1970s (average of 1975 and 1976) to 4.15 per cent (average of 1984 and 1985) within a decade, despite its being the largest producer of groundnut in the world. USA and China control about 57 per cent of world exports of groundnut (average of 1984 and 1985).

4.11 From 1986-87 onwards, the Government of India decanalized the exports of HPS groundnuts, hoping for their revival. Exports of groundnut are now allowed under OGL-3 against contracts registered with Agricultural Products Exports Development Authority (APEDA), and a public notice (dated 27th January 1987) was issued to this effect. But this had little impact because of low international prices and the aflatoxin problem. One suggestion to boost groundnut has been to give the exporters Replenishment (REP) licences for imports of oilseeds. The REP scheme is considered better than the Cash Compensatory Scheme (CCS) as REP is self-compensatory in the sense that if the local prices go up, then the REP value would also go up, and the exporter will automatically stand compensated.[9]

4.12 On domestic production front, groundnut is India's second most important cash crop (next to cotton), accounting for 4.1 per cent of the gross cropped area 1982-83. Of the nine major oilseeds, groundnut predominates, accounting for as much as 53 per cent of oilseeds production

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[8] Aflatoxin is a form of fungus produced by secondary metabolies of the moulds - Aspergillus Flavus Toxin. It is highly toxic and may cause death of animals and human beings. High moisture content is the prime factor in its growth. In case of groundnuts, if moisture content exceeds 8 to 9 per cent and in case of groundnut cake if it exceeds 12 per cent, aflatoxin is likely to grow. It can also occur during long voyages, if packing is not done with due care. In 1978-79, the UK's Ministry of Agriculture, Fisheries and Food discovered a high degree of aflatoxin in groundnut and cottonseed extractions used as cattle feed formulations and banned the imports of these commodities. This ban was imposed by other importers, which demanded aflatoxin free delivery of these goods at their ports. The Groundnut Extraction Export Development Association (GEEDA) assured the importing countries in 1983-84 that a satisfactory solution to aflatoxin problems would be found in near future. At present the maximum acceptable limit of aflatoxin is 0.005 parts per million. See NAFED (1986): Groundnut, Commodity Bulletin, pp. 36-36.

[9] See Suresh Shah (1987): "Huge Potential for exports of HPS groundnuts", The Economic Times, September 12, 1987. A similar suggestion was put forward by P. K. Nagar in 1982-83, See G. Ganguly (1982-83); and Kaku Tanna (1984), "Propping up Peanut Exports", 22nd All India Convention of Oilseeds and Oils Trade and Industry, Delhi Vegetable Oil Traders' Association, November 30, 1984.

and 40 per cent of area.[10] During 1967-68 to 1984-85, groundnut production increased by 1.29 per cent per annum. The Seventh Plan aims at boosting groundnut production from the assumed base level of 7.30 million tonnes in 1984-85 to 9.37 million tonnes by 1989-90, implying a growth rate of 5.11 per cent per annum. In order to achieve this ambitious target, the Government initiated NODP in 1984-85 by reorienting and integrating the existing Centrally Sponsored Scheme and two Special Projects on groundnut and soyabean. Under NODP, groundnut production is to receive intensive treatment in Gujarat, Andhra Pradesh, Tamil Nadu, Orissa and Maharashtra. The main focus is to increase the groundnut area during the rabi season, which provides much higher yields.[11] However, groundnut cultivation is still largely a kharif crop on unirrigated land (85% of the area is unirrigated). Thus it remains a gamble on rainfall. As a consequence it experiences wide gyrations in yields, production and thereby prices,[12] affecting adversely farmers' incentives to apply modern inputs. The Government appointed NAFED as a procuring agency for groundnuts, responsible for providing an effective floor/support price to the cultivators on an ad-hoc basis since 1976-77. In 1985/86 NAFED was appointed as a nodal agency for price support operations for the Seventh Five Year Plan (1985-86 to 1989-90). In 1989 this system was changed again, as part of a buffer stock scheme for oilseeds. The National Dairy Development board was appointed the executing agency.

4.13 India produces a large number of groundnut varieites, of which about 29 improved varieties are grown on a large scale. These varieties are normally categorised into three groups: (a) Bunch (Spanish/Valencia), (b) Semi-Spreading (Virginia Bunch) and (c) Spreading (Virginia Runner). Gujarat, which is the most dominant groundnut producing state, basically grows spreading varieties (like Punjab-1 which is Spreading Spanish and M-13, GAUG-10 both of which are Virginia Runners). Tamil Nadu grows mainly Bunch varieties (TVM-2, 6, 8, 9, 11, 12 and POL-1, POL-2), while Andhra Pradesh grows a mixture of all these. For export purposes, however, Indian groundnuts are all classified primarily into two groups: (a) HPS kernels, bold and (b) HPS kernels jawa type. In the bold variety, usually the count is 55-60 kernels per ounce while in jawa variety it is between 75-80 kernels per ounce.

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[10] Average of 1982-83 to 1984-85 Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. Then nine major oilseeds are - Groundnut (53.41%), Rapeseed and Mustard (21.92%), Soyabean (5.70%), Sesamum (4.57%), Safflower (3.81%), Castorseed (3.41%), Linseed (3.37%), Sunflower (2.50%) and Nigerseed (1.23%).

[11] Annual Report, 1984-85, Department of Agriculture and Cooperation, Ministry of Agriculture and Rural Development, Government of India, pp. 77-78.

[12] For greater details on the price instability of groundnut, see Purkayastha and Subramanian (1986).

4.14 Amongst the different states in India, Gujarat, Andhra Pradesh and Tamil Nadu are the major producers of groundnut, accounting for more than 62 per cent of production as well as area. Within these states, groundnut cultivation is heavily concentrated in a few districts. In fact, seven districts in the country together account for about 31 per cent of total groundnut area (Four of these districts are in Gujarat, two in Andhra Pradesh and one in Tamil Nadu). As noted above, groundnut is cultivated in both during kharif and rabi seasons, but the share of kharif crop in total production remains predominant, with 73 per cent at the all-India level and varies between 66 per cent in Tamil Nadu to 83 per cent in Gujarat (Annexure 2). Statewise growth performance of groundnut (area, production and yield) for the pre and post Green Revolution period is shown in Annexure 3.

4.15 The pattern of market arrivals of groundnut differs from state to state. In Gujarat, where the share of kharif groundnut is overwhelming, arrivals are heaviest in the first quarter of post-harvest period (October-December), while in Andhra Pradesh and particularly Tamil Nadu, the flow of market arrivals is more evenly spread out over the entire year.

4.16 Groundnuts are marketed through various trade channels: village traders, outside traders operating in the village during post-harvest season, commission agents in regulated markets, oil millers and cooperatives agencies. Not much information is available about the share of different trade channels in total purchases of groundnut from the farmers. The scattered evidence shows that private trade continues to be the dominant channel and the main link between farmers and oil millers (Modak, 1986). Recently, efforts have been made to provide alternative marketing channels in the form of cooperative societies especially meant for oilseeds. The initiation of the National Oilseeds Project under the National Dairy Development Board (NDDB) in 1979 was a major step in this direction. Under this project state level cooperative federations of oilseed growers have been set up in seven states, viz., Gujarat, Andhra Pradesh, Tamil Nadu, Maharashtra, Karnataka, Orissa and Madhya Pradesh. These state level federations have further set up village level cooperatives of oilseeds growers. Nonetheless, their role as procuring agency was quite limited up to 1988. This was because (a) the market prices normally were above the official support prices and (b) the purchases of oilseeds by cooperative federations are limited to their requirements for the oil processing plants owned by them. However, the role of the NDDB, and the cooperatives, is likely to increase under the price support/buffer stock scheme announced in early 1989.

4.17 Futures trading in groundnuts has been banned since 1965, but it still continues illegally in Rajkot, though at a reduced scale and with greater risk.[13]

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[13] See Tushar Shah and Shrikant Modak (1986).

B. Nominal Protection Coefficients (NPCs) of Groundnut

4.18 The NPC of groundnut (with shell) is defined as a ratio of domestic price of groundnuts to the international reference price (see chapter 1). The NPC has been estimated under the importable and exportable hypotheses for three different states - Gujarat, Andhra Pradesh and Tamil Nadu -- which together account for more than 60 per cent of all-India groundnut production. The point of competition between domestic production and imports of groundnut kernels (from the USA) taken for the importable hypothesis is a port city in the West (Kandla) or in the south (Madras). The international reference price under this hypothesis thus would be calculated by adjusting the fob price of groundnuts at the US port by adding insurance and maritime freight from USA to the relevant Indian port, and then deducting domestic transport costs, marketing and trading margins from the Indian port to the specific region. The resulting international reference price is compared with the domestic price, to derive the NPCs of groundnut. The domestic prices were approximated by month end wholesale prices in the major markets of relevant states, averages over those months that account for bulk of market arrivals in the relevant state (see Annexures 6 to 8).

4.19 The resulting weighted average NPCs for groundnut fluctuated between 1.06 in 1980-81 to 2.05 in 1986-87 with an average of 50 for the seven year period, 1980-81 to 1986-87 (Table 4.1). There seems to have been a sharp increase in NPCs during 1981-82, 1982-83 and again in 1986-87, primarily due to the sharp fall in international prices during these years. The NPCs across states did not vary significantly; the lowest NPC was for Gujarat (1.47), and highest for Tamil Nadu (1.53) with Andhra Pradesh falling in between (1.50). In other words, domestic prices of groundnuts averaged about 50% more than imports, implying that groundnuts receive a significant degree of nominal protection from the existing policies.

4.20 Under the exportable hypothesis, the presumption is that Indian groundnut would compete with US groundnut in Europe (Rotterdam), which is world's biggest market for groundnuts. Since competition is assumed to take place in Europe, estimation of the international reference price entails deducting shipping cost, domestic marketing costs and trading margins etc. from the cif price at Rotterdam (see Annexures 11 to 13). The resulting set of NPCs (Table 1) also indicates a high level of protection with a weighted average NPC being 1.91 for the period 1980-81 to 1986-87, although it fluctuated between 1.25 in 1980-81 to 2.87 in 1986-87. The level of incentives, thus, was significantly higher under exportable hypothesis than that estimated under importable hypothesis, primarily due to differences in the treatment accorded to transport and other associated costs in calculating reference prices. Since these costs form a significant proportion of reference prices, the method of their treatment has a noticeable impact on final estimates of NPCs. As with the importable hypothesis, there was little variance between the states in terms of protection, with Tamil Nadu at top (NPC = 1.95), followed by Andhra Pradesh (NPC = 1.91) and Gujarat (NPC = 1.87) (see Table 4.1). Not surprisingly, given these estimates and the aflatoxin problem, Indian exports of groundnuts to hard currency areas have been limited in the 1980s.

Table 4.1: Nominal Protection Coefficients of Groundnut (with shell)

Hypothesis/States	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Gujarat	1.09	1.39	1.63	1.56	1.40	1.55	1.69	1.47
	(0.49)	(0.46)	(0.40)	(0.38)	(0.41)	(0.15)	(0.35)	(0.38)
Andhra Pradesh	1.02	1.36	1.64	1.31	1.40	1.52	2.23	1.50
	(0.28)	(0.29)	(0.34)	(0.39)	(0.33)	(0.43)	(0.36)	(0.35)
Tamil Nadu	1.05	1.35	1.74	1.41	1.40	1.52	2.25	1.53
	(0.23)	(0.25)	(0.26)	(0.22)	(0.26)	(0.40)	(0.29)	(0.27)
Weighted Average	1.06	1.37	1.66	1.41	1.40	1.53	2.05	1.50
Exportable Hypothesis								
Gujarat	1.31	1.73	1.99	1.86	1.76	2.05	2.37	1.87
	(0.48)	(0.46)	(0.39)	(0.38)	(0.41)	(0.15)	(0.35)	(0.37)
Andhra Pradesh	1.18	1.72	2.00	1.54	1.76	2.02	3.12	1.91
	(0.29)	(0.29)	(0.35)	(0.39)	(0.32)	(0.45)	(0.36)	(0.35)
Tamil Nadu	1.21	1.70	2.11	1.67	1.77	2.02	3.15	1.95
	(0.23)	(0.25)	(0.26)	(0.23)	(0.27)	(0.40)	(0.29)	(0.28)
Weighted Average	1.25	1.72	2.03	1.69	1.76	2.03	2.87	1.91

Notes:

1. Figures in parentheses are value weights derived by working out relative share of each state in total groundnut production valued at internatiuonal (reference) prices.

2. For details on estimation of NPCs and value weights, see Annexures 6 to 13.

C. Effective Protection Coefficients (EPCs) of Groundnut

4.21 The effective protection coefficient, (EPC) is defined as ratio of value added at domestic prices to value added at reference prices, where value added is calculated as the difference between gross value of output and tradeable inputs (See Equation (2) of Chapter 1).

4.22 The EPCs for groundnut were estimated on the basis of Equation (2) of Chapter 1, using the NPCs estimated in section B and the input structure and NPCs of tradeable inputs. Annexure 14 presents the input structures for Gujarat, Andhra Pradesh and Tamil Nadu. They have been averaged over three years (1981-82 to 1983-84) to bring about stability in input-output relations. The input structures reveal that the major tradeable inputs of groundnut are seeds, fertilisers and machinery. While the NPCs of seeds can be approximated by NPCs of groundnut itself (due to lack of any information an international prices of groundnut seeds), the NPCs of fertilizers (N, P and K) and machinery are estimated at national levels using the results of Chapter 2. The NPCs of tradeable inputs so obtained and approximated at state levels have been averaged by using their value weights, which yields weighted average NPCs of all tradeable inputs that go to produce one unit of output (annexure 15). These NPCs and the NPCs of groundnut derived in Table 4.1, are plugged in equation (2) of chapter 1, to calculate the EPCs of groundnut under the importable and exportable hypotheses -- See Table 4.2.

4.23 The EPCs of groundnut, on an average, turn out to be higher than their corresponding NPCs. This is because protection of the tradeable inputs generally was below protection of groundnut (as measured by NPCs). The weighted average EPCs of groundnut fluctuated between 1.09 in 1980-81 and 2.13 in 1986-87, with an average at 1.56, under the importable hypothesis.

4.24 The temporal and spatial variation of effective protection is dominated by the nominal protection coefficients, as inputs are relatively small and have only slightly less nominal protection than groundnuts. Hence, average effective protection increased sharply in 1981/82, 1982/83 and 1986/87 and across states the differences in EPCs were not very large.

D. Effective Subsidy Coefficients (ESCs) of Groundnut

4.25 The ESCs of groundnut are obtained by adding subsidies on non-tradeable inputs like irrigation (canal), electricity and credit on a per quintal (of groundnut) basis into the numerator of equation (2). As was done in the earlier chapters, irrigation and electricity subsidies are basically defined as the difference between their respective resource costs (including interest and depreciation on capital invested) and revenue receipts, while the credit subsidy is the sum of the interest subsidy and default subsidy. The interest subsidy is estimated as the difference in rates of interest being charged by financial institutions on agriculture and retail trade (4.5%), and the default subsidy as 40 per

Table 4.2: Effective Protection Coefficients of Groundnut (with shell)

Hypothesis/States	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Gujarat	1.14	1.51	1.78	1.67	1.52	1.70	1.84	1.59
Andhra Pradesh	1.04	1.40	1.69	1.34	1.45	1.57	2 29	1.54
Tamil Nadu	1.06	1.36	1.76	1.42	1.42	1.54	2.28	1.55
Weighted Average	1.09	1.44	1.74	1.47	1.47	1.58	2.13	1.56
Exportable Hypothesis								
Gujarat	1.61	2.27	2.59	2.21	2.24	2.76	3.37	2.48
Andhra Pradesh	1.28	1.99	2.25	1.67	1.98	2.34	3.54	2.15
Tamil Nadu	1.27	1.86	2.45	1.76	1.91	2.22	3.43	2.13
Weighted Average	1.44	2.09	2.44	1.90	2.07	2.36	3.45	2.26

Note: Weights are the same as in Table 1.

cent of those loans which have a default history of more than three years.[14]

4.26 Briefly, the subsidies are calculated as follows: In case of irrigation, resource cost includes a 10 per cent charge on capital invested on major and medium irrigation schemes (8.44% as interest cost and 1.56% as depreciation) and the subsidy is allocated across different crops on the basis of their relative irrigation water requirements. The electric subsidy is based on electricity consumption specific to each crop, which in turn is primarily based on their relative water requirements. The credit subsidy reflects an interest subsidy (4.5% p.a.) and a defalut subsidy, which is allocated across different crops on the basis of their value productivity i.e., a high value crop will have relatively more credit subsidy (on per quintal basis) than a low value crop. The underlying assumption is that credit subsidy is same for all crops on per unit of value added basis i.e., on every rupee originating through crop output.

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[14] For greater details on definitional concepts and methodologies followed in estimating these subsidies at state levels and then allocating them across different crops, see Gulati, 1988a and Gulati, 1988b.

4.27 These subsidies on non-tradeable inputs, so derived, for the selected states over seven years (1980-81 to 1986-87) are presented in Table 4.3. These subsidies on a per quintal of groundnut basis turn out to be highest in Tamil Nadu. Subsidies are much lower in Gujarat, where groundnut is largely unirrigated. The high subsidy in 1985-86 in Gujarat stems from extremely low yields of groundnut due to crop failure in that year.

4.28 By adding these subsidies into the numerator of equation (2) in chapter 1, one obtains ESCs on state and year-wise basis, under the importable and exportable hypotheses (Table 4.4). ESCs are obviously higher than their corresponding EPCs. Under the importable hypothesis, e.g. the weighted average ESC is 1.71; it has increased from 1.20 in 1980-81 to 2.32 in 1986-87. There are hardly any inter-state differences in the ESCs, the lowest being Gujarat's average of 1.70 and the highest Tamil Nadu's 1.73. Under the exportable hypothesis there is a greater difference and the ranking of the states reverses with Gujarat at the top (ESC = 2.60), followed by Andhra Pradesh (ESC = 2.42) and Tamil Nadu (ESC = 2.38). This difference between the results under the two hypotheses reflects the differences in the treatment of transportation costs and associated expenses. Finally, it should be noted that estimated subsidies amount to about 13% of value added.

E. Concluding Remarks and Future Outlook

4.29 What do the estimated results NPCs, EPCs and ESCs for groundnuts reveal and what implications do they have for agricultural price and/or trade policy? The estimated NPCs, EPCs and ESCs for groundnuts were above unity in all the years under consideration and for all relevant states analysed in this study. For example, the weighted ESCs, that is the effective protection, adjusted for subsidies, exceeded one in all years and has gone up from 1.20 in 1980-81 to 2.32 in 1986-87, with an average at 1.71. This strongly suggests that groundnut cultivators in India have, on balance, received growing protection, that has become substantial. This, largely reflects falling world prices of groundnut, oil and meals which were not offset by exchange rate increaments.

4.30 It may be noted that during 1986-87 there was a sudden upward jump in the protection coefficient, primarily due to a sharp decline in international prices of groundnut oil and meals, which affect the price of groundnut kernels. The world price of groundnut oil at 1985 constant US dollars, for example, dropped from $905/MT in 1985 to $481/MT in 1986 and further $382/MT in 1987 (Table 4.5). The year 1987-88 was one of severe drought in India and groundnut was one of the crops most affected, which resulted in a sharp increase of its domestic price. This implies that ESC in 1987-88 would be even higher than what prevailed in 1986-87.

4.31 The short-term projections (up to 1990) of world price of groundnut oil indicate that the prices will remain depressed between 1986 and 1987 levels. And even the long-term projections (up to 2000 AD) indicate that world prices of groundnut oil are not likely to return to their 1985 levels. Given this future scenario, it is very likely that Indian groundnut cultivators will remain protected in the coming years. The degree of net protection is likely to increase given an increasing

emphasis on oilseeds at home under Technology Mission on Oilseeds, which seeks to extend more incentives of cultivators of oilseeds, including groundnut.

4.32 This situation of net protection would remain in existence even if one adjusts the estimated protection coefficients by attaching a

Table 4.3: Subsidies on Non-tradeable Inputs of Groundnut (Rs/q)

State	Input	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Gujarat	IS	5.19	4.40	7.49	6.18	7.43	2e.68	9.49
	ES	0.16	0.06	0.19	0.15	0.25	0.92	0.29
	CS	5.87	6.34	8.16	8.50	8.25	16.04	15.45
	TS	11.22	10.80	15.84	14.83	15.93	41.64	25.23
Andhra Pradesh	IS	34.70	23.32	30.90	22.75	31.49	30.01	28.08
	ES	0.38	0.34	0.61	0.60	0.84	0.79	0.88
	CS	7.28	6.63	8.03	8.37	11.00	12.59	16.50
	TS	42.36	30.29	39.54	31.72	43.33	43.39	45.46
Tamil Nadu	IS	27.46	19.53	25.69	23.61	23.81	19.54	23.63
	ES	1.01	1.01	1.98	2.05	1.79	1.79	2.15
	CS	10.48	9.85	22.13	17.75	20.35	20.94	27.67
	TS	38.95	30.39	49.80	43.41	45.95	42.27	53.45

Note: A very high ISD in Gujarat during 1985-86 .esults due to an abnormally sharp decline in groundnut yield in Gujarat.

IS = Irrigation Subsidy; Es = Electricity Subsidy
CS = Credit Subsidy; TS = Total Subsidy

premium on foreign exchange (shadow pricing). The adjusted ESCs, so derived after using a shadow exchange rate (about 25 per cent higher than official exchange rate), still indicate that groundnut is neither an efficient exportable commodity nor an efficient import substitute. It also implies that investment programs to expand production of groundnuts in India, would provide low economic rate of return. Unless an implicit and very high weight is attached to the objective of self-sufficiency in groundnut (or the oilseeds crop complex) within an overall framework of Social Benefit-Cost analysis, the Benefit-Cost ratio is not likely to be favourable. Even if self-sufficiency has to be achieved in oilseeds crop-complex, it should be attained through the least-domestic resource cost (DRC) combination. This implies that ESCs of other oilseeds should be computed and compared so that a least-cost cropping pattern for oilseeds can be developed.

Table 4.4: Effective Subsidy Coefficients of Groundnut (with shell)

Hypothesis/State	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Importable Hypothesis								
Gujarat	1.20	1.57	1.89	1.74	1.59	1.91	1.98	1.70
Andhra Pradesh	1.20	1.56	1.92	1.47	1.62	1.76	2.50	1.72
Tamil Nadu	1.19	1.51	2.02	1.58	1.59	1.71	2.51	1.73
Weighted Average	1.20	1.55	1.93	1.58	1.60	1.76	2.32	1.71
Exportable Hypothesis								
Gujarat	1.69	2.36	2.75	2.30	2.35	3.10	3.64	2.60
Andhra Pradesh	1.47	2.20	2.55	1.83	2.40	2.62	3.86	2.42
Tamil Nadu	1.43	2.06	2.81	1.96	2.15	2.47	3.78	2.38
Weighted Average	1.57	2.24	2.69	2.04	2.31	2.63	3.76	2.47

Note: Weights are the same as in Table 1.

4.33 In this context it is sometimes argued that the estimates of ESCs (and DRCs) are static in nature and therefore do not provide any guidance for future policy options. This argument is often raised in Indian context where the Technology Mission on Oilseeds is aiming at restructuring the oilseeds economy by upgrading technology in oilseeds from the crop itself (seeds) to the processing and storage stage. One question of course is whether this can be achieved at a reasonable investment. In Indian case where about 85 per cent of area under oilseeds is unirrigated, prospects of making groundnut as economically efficient crop seem poor, unless a "miracle" seed is invented for dry farming areas. Moreover, under-current arrangements, there is only a tenous link between higher prices and development of such a seed by the research-extension complex. Hence, there is little basis for an "infant industry" argument for protection to promote a technological breakthrough. The situation is very different from the Green Revolution in wheat and rice, where such "miracle" seeds already existed and reasonable support prices contributed to their adoption. Once such a seed is developed for groundnuts, then price policy would be another matter. There is also substantial room for upgrading processing and storage in the oilseeds industry - the issues are whether this is stimulated by higher oilseeds prices, or whether such efforts at improving the downstream

Table 4.5: Temporal Behaviour of Protection Coefficients (weighted Average) and International Process

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Importable Hypothesis							
NPCs	1.06	1.37	1.66	1.41	1.40	1.53	2.05
EPCs	1.09	1.44	1.74	1.47	1.47	1.58	2.13
ESCs	1.20	1.55	1.93	1.58	1.60	1.76	2.32
Exportable Hypothesis							
NPCs	1.25	1.72	2.03	1.69	1.76	2.03	2.87
EPCs	1.44	2.09	2.44	1.90	2.07	2.36	3.45
ESCs	1.57	2.24	2.69	2.04	2.31	2.63	3.76

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1995
International Price of Groundnut Oil*	824	995	566	706	1027	905	481	382	390	425	430	589
Groundnut Meal* (*at 1985 contant $/MT, Rotterdam)	230	227	183	199	189	143	139	124	132	137	137	144

Source: Half Year Revision of Commodity Price Forecasts - January 1988, International Commodity Markets Division, International Economics Department, The World Bank (for international prices of groundnut oil and meals).

facilities might not better be focussed elsewhere. The whole point of the foregoing analysis is to illustrate that what appears to be an obvious case of import substitution may well be inefficient when compared with the alternatives, such as increased exports of cotton. Attempts to use price policy to increase production of groundnuts (or for that matter other oilseeds) may well result in the substitution of oilseeds for other crops that are relatively more efficient in terms of foreign exchange earning capacity (such as cotton, rice or wheat). Thus the price stimulus to oilseeds may not only run counter to the principal of comparative advantage, it may end up reducing net foreign exchange earnings.

Table 4.6: Regional Dispersion of Effective Incentives for Groundnut Cultivators
(Average 1980-81 to 1986-87)

Hypothesis/Protection Coefficient	Gujarat	Andhra Pradesh	Tamil Nadu	Weighted Average
Importable Hypothesis				
NPCs	1.47	1.50	1.53	1.50
EPCs	1.59	1.54	1.55	1.56
ESCs	1.70	1.72	1.73	1.71
Index of ESCs (Weighted AV = 100)	99.41	100.58	101.17	100.00
Exportable Hypothesis				
NPCs	1.87	1.91	1.95	1.91
EPCs	2.48	2.15	2.13	2.26
ESCs	2.60	2.42	2.38	2.47
Index of ESCs (Weighted AV = 100)	105.26	97.97	96.36	100.00

Annexure I: Exports of HPS Groundnuts from India (1974-75 to 1985-86)

Financial Year	Quantity ('000 tonnes)	Value (Rs.million)	Unit Value (Rs/tonnes)	Export Quota ('000 tonnes)	Remarks
1974-75	55.72	255.64	4588		1974-75 to 1977-78, period of canalisation through IOPEA
1975-76	112.80	498.37	4418		
1976-77	122.81	594.00	4837		
1977-78	4.76	8.10	1702		
1978-79	4.45	28.84	6473	25	1978-79 to 1981-82, period of canalisation through NAFED
1979-80	23.12	135.78	5873	50	
1980-81	58.29	531.02	9110	50	
1981-82	16.56	181.58	10965	55	
1982-83	32.62	309.41	9485	100	1982-83 to 1985-86, period of canalisation through NAFED, but private trade also allowed to export as associate shippers.
	(13.74)	(136.91)	(9964)		
	/18.88/	/172.50/	/9137/		
1983-84	24.71	221.15	8950	110	
	(5.60)	(50.78)	(9068)		
	/19.11/	/170.37/	/8915/		
1984-85	27.80	236.93	8523	110	
	(5.36)	(45.01)	(8397)		
	/22.44/	/191.92/	/8553/		
1985-86	9.97	83.80	8405		
	(2.65)	(22.30)	(8415)		
	/7.32/	/61.50/	/8402/		
1986-87					1986-87 exports decanalised

Notes: 1. Figures in parentheses relate to those of NAFED and within slashes of Associate shippers.

ANNEXURE 2: REGIONAL DIMENSIONS OF GROUNDNUT PRODUCTION IN INDIA

		Average 1982-83 to 1984-85				
		Production (% share)	Area (% share)	Yield (Kgs/ha) weighted average	Share of Kharif g'nut production in total g'nut production of the states (%)	Irrigated area under g'nut as % of total area under g'nut (1982-83)
Gujarat	T	24.56	27.85	749		10.7
	K	28.00	30.31	674	82.94	
	R/S	15.39	14.24	1630		
Andhra Pradesh	T	21.83	21.61	858		19.2
	K	20.10	20.49	716	67.00	
	R/S	26.45	27.78	1430		
Tamil Nadu	T	16.14	13.41	1022		24.9
	K	14.58	11.74	906	65.76	
	R/S	20.29	22.66	1348		
Maharashtra	T	11.57	10.44	941		11.2
	K	10.91	9.75	818	68.66	
	R/S	13.31	14.24	1406		
Karnataka	T	10.70	11.42	796		14.1
	K	9.99	11.65	626	67.89	
	R/S	12.62	10.16	1867		
Others	T	15.20	15.27	845		-
	K	16.41	16.07	746	78.62	
	R/S	11.94	10.92	1642		
All India	T	100(6371)	100(7502)	849		14.7
	K	100(4636)	100(6350)	730	72.77	
	R/S	100(1735)	100(1152)	1506		

Notes:
1. T = Total K = Kharif R/S = Rabi/Summer
2. Figures in parantheses against production are in '000 tonnes and against area are in '000 hectares.

Sources:
1. Estimates of Area and Production of Principal Crops in India, Ministry of Agriculture, Govt. of India (different years)
2. Agricultural Statistics at a Glance, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, April, 1986.

Annexure 3: Growth Performance of Groundnut in India, Selected States

	States		Growth Rates (per cent per annum) 1954-55 to 1983-84	1954-55 to 1964-65	1967-68 to 1983-84
1.	Gujarat	P	2.93*	10.89*	3.42***
		A	1.18*	8.53*	1.39*
		Y	1.89*	3.21 ns	2.05 ns
2.	Andhra Pradesh	P	1.31**	-5.28**	1.38*
		A	1.14*	-3.80**	0.29 ns
		Y	0.08 ns	-1.56***	0.97 ns
3.	Tamil Nadu	P	0.33 ns	2.36**	0.38 ns
		A	0.86*	2.60*	0.03 ns
		Y	-0.59**	-0.19 ns	0.44 ns
4.	Maharashtra	P	-0.98**	1.39**	0.86 ns
		A	-1.50*	1.14**	-1.15**
		Y	0.63 ns	0.47 ns	2.10**
5.	Karnataka	P	0.23 ns	-0.83 ns	0.96 ns
		A	-0.27*	0.14 ns	0.13 ns
		Y	0.50 ns	-0.96 ns	0.89 ns
6.	All India	P	1.27*	3.17*	1.25***
		A	0.70*	3.22*	0.04 ns
		Y	0.53**	-0.07 ns	1.18***

Notes:

1. Growth rates are linear trends with slope expressed as per cent at respective means.
2. *, **, *** imply significant at 1, 5 and 10 per cent level of significance, respectively ns- not significant even at 10 per cent level of significance.
3. P - production, A - Area and Y - Yield.

Source: K.N. Ninan (1987): "Edible Oilseeds - Growth and Area Responses", Economic and Political Weekly, (Review of Agriculture), September 26, 1987.

Annexure 4: Maritime Freight Rates for Groundnut Kernels

(S/MT)

Year	US gulf to Rotterdam	US gulf to India	Rotterdam to India
1980-81	29.63	86.18	29.63
1981-82	20.16	74.27	20.16
1982-83	17.07	47.26	17.07
1983-84	18.80	48.00	18.80
1984-85	20.19	48.00	20.19
1985-86	17.54	48.00	17.54
1986-87	18.50	40.53	18.50

Notes: 1. These are approximate freight rates estimated on the basis of wheat freight rates published by FAO.

2. Freight rates for groundnut Kernels are taken as 1.6 times the wheat freight rates between US gulf to Rotterdam, and US gulf to India, because (a) groundnut Kernels are relatively more voluminous (b) their trading and transportation is relatively less frequent and (c) these are transported in smaller quantities.

3. Freight rates from Rotterdam to India are treated as equal to those between US gulf to Rotterdam.

Annexure 5: Marketing Costs and Associated Expenses in Groundnut Trading in Gujarat (Average of 1980-81 to 1986-87)

	Particulars	
1.	Purchase Tax	4% of pod value
2.	Surcharge	1% on purchase tax
3.	Arat (Commission)	1.5% of pod value
4.	Mandi tax	1% of pod value
5.	Handling expenses (weighting, filling, stitching, transportation sutli, wasking, stacking and destacking).	2% of pod value
6.	Domestic insurance	0.1% of pod value
7.	Interest for one month @ 18% p.a. on pod value	1.5% of pod value
8.	Gunny bags, storage charges and decortication expenses	Rs. 16/quintal of pods.
9.	Port expenses (transportation to port, fob expenses and survey charges)	Rs. 10/quintal of Kernels (= Rs. 7/quintal of pods)
	Total marketing costs and associated expenses (excluding purchase tax and surcharge on that) (i.e. Row 3 to Row 9)	= 6.1% of pod value plus Rs. 23/q of pod weight which is equivalent to $\frac{1}{0.7}(0.061\ P_P^M + 23)$ per quintal of Kernels

Notes:

1. These are approximate marketing costs and expenses as explained by NAFED, an agency responsible for undertaking support operations in case of oilseeds.

2. The conversion ratio of pods to kernels is 1:0.7, which is also the one normally taken by NAFED.

3. The relevant reference price for groundnut pods (P_P^M) under importable hypothesis thus, can be estimated as

$$\frac{1}{0.7}(P_P^M + 0.061\ P_P^M + 23) = P_K$$

$$P_P^M = (P_K - 32.86)/1.52$$

Where P_P^M is the maximum possible price of groundnut pods; P_K is the landed cost of imported groundnut Kernels at Kandla (Gujarat).

4. Purchase tax and surcharge are excluded as they are not deemed to represent marketing costs while mandi tax and Arat are included as they are representing transaction costs in the market.

Annexure 6: Gujarat : Estimation of NPCs of Groundnut (with shell) (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1. Cif price of groundnut (Kerlans) at Rotterdam (Oct-March)	US $/MT	608.00	445.83	365.67[1]	438.00	380.83	355.00	293.00	
2. Minus freight from US gulf to Rotterdam[2]	$/MT	29.63	20.16	17.07	18.80	20.19	17.54	18.50	
3. Minus freight from US gulf to India	$/MT	86.18	74.27	47.26	48.00	48.00	48.00	40.53	
4. Equals cif price at Kandla (Gujarat)	$/MT	664.55	499.94	395.86	467.20	408.64	385.46	315.03	
5. Exchange Rate (Oct-March)	1$=Rs.	7.99	9.17	9.82	10.53	12.41	12.17	13.00	
6. Equals cif price at Kandla (Row 4 x Row 5)/10	Rs/q	530.97	458.44	388.73	491.96	507.12	469.10	409.54	
7. Plus approx. port clearance charges[3]	Rs/q	5.00[e]	6.99	7.44	10.18	18.44	25.00[e]	30.00[e]	
8. Equals landed cost of groundnut kernels at Kandla(6+7)	Rs/q	535.97	465.43	396.17	502.14	525.56	494.10	439.54	
9. Reference price of groundnut pods $P_p = (P_k - 32.86)/1.52$ (see Annex-5)	Rs/q (of pods)	330.99	284.30	239.02	308.74	324.14	303.45	267.55	
10 Wholesale price of groundnut pods in Gujarat[5] (Rajkot) (October-March)	Rs/q	360.33	394.00	390.6.	483.25	453.33	470.67	453.33	
11 NPCs of groundnut (with shell) (Row 10/Row 9)		1.09	1.39	1.63	1.56	1.40	1.55	1.69	1.47

Notes:

1. From January to March (due to gap in FAO price series)
2. See Annexure 4.
3. Assumed to be the same as that for wheat (e = estimated)
4. See Annexure 5, footnote 3.
5. These are month-end wholesale prices (October-March) prevailing in Rajkot market.

Sources:

1. FAO Monthly Bulletin of Statistics (various issues) (for cif price data).
2. RBI Bulletin (various issues) (for Exchange Rate).
3. Directorate of Economics and Statistics (Ministry of Agriculture) for domestic price data.
4. USDA for cif price data for later years

Annexure 7: Andhra Pradesh : Estimation of NPCs of Groundnut (with shell) (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1. Cif price of groundnut Kernels at Rotterdam (Oct-June)	$/MT	663.86	428.44	367.83[1]	461.00	377.78	348.00	296.00	
2. Minus freight from US gulf to Rottardam[2]	$/MT	29.63	20.16	17.07	18.80	20.19	17.54	18.50	
3. Plus freight from US gulf to India	$/MT	86.18	74.27	47.26	48.00	48.00	48.00	40.53	
4. Equals Cif price at Madras	$/MT	720.41	482.55	398.02	490.20	405.59	378.46	318.03	
5. Exchange Rate (Oct-June)	1$/Rs.	8.16	9.24	9.88	10.70	12.42	12.29	12.92	
6. Equals cif price at Madras (Row 4 x Row 5)/10	Rs/q	587.85	445.88	393.24	524.51	503.74	465.13	410.89	
7. Plus (approx) port clearance charges[3]	Rs/q	00[e]	6.99	7.44	10.18	18.44	25.00[e]	30.00[e]	
8. Equals landed cost of groundnut kernels at Madras(6+7).	Rs/q	592.85	452.87	400.68	534.69	522.18	490.13	440.89	
9. Reference price of groundnut pods $\Rightarrow P_P^R = (P_K - 32.86)/1.52$ (see Annexure 5)	Rs/q	368.41	276.32	241.99	330.15	321.92	300.83	268.44	
10. Wholesale price of groundnut pods in Andhra Pradesh (Madyal) (Oct-June)	Rs/q	377.44	376.78	307.78	431.56	449.11	458.12	600.00	
11 NPCs of groundnut pods (Row 10 / Row 9)		1.02	1.36	1.64	1.31	1.40	1.52	2.23	1.50

Notes and References: Same as in Annexure 6.

Annexure 8: Tamil Nadu : Estimation of NPCs of Groundnut (with shell) (Importable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1. Reference price of groundnut pods (same as that for Andhra Pradesh)	Rs/q	368.41	276.32	241.99	330.15	321.92	300.83	268.44	
2. Wholesale price of groundnut pods in Tamil Nadu (Madras) (derived by multiplying shelled peanut prices by a factor of 0.7)	Rs/q	385.58	373.22	420.00	465.97	451.42	458.27	604.80	
3. NPCs of groundnut pods (Row 2 / Row 1)		1.05	1.35	1.74	1.41	1.40	1.52	2.25	1.53

For Notes and References see Annexure 6.

Annexure 9: Estimation of Regional (value) Weights for Groundnut (with shell) (Importable Hypothesis)

State	Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Gujarat	Groundnut Produc.	m.t.	1.64	2.20	1.31	1.81	1.57	0.45	1.29	
	Reference Price	Rs/q	330.99	284.30	239.02	308.74	324.14	303.45	267.55	
	Value	Rs 10 m.	542.82	625.46	313.12	558.82	508.90	136.55	345.14	
	Value weight		0.49	0.46	0.40	0.38	0.41	0.15	0.35	0.38
Andhra Pradesh	Groundnut Produc.	m.t.	0.86	1.44	1.13	1.72	1.26	1.32	1.35	
	Reference Price	Rs./q	368.41	276.32	241.99	330.15	321.92	300.83	268.44	
	Value	Rs. 10 m.	316.83	397.90	273.45	567.86	405.62	397.10	362.39	
	Value weight		0.28	0.29	0.34	0.39	0.33	0.45	0.36	0.35
Tamil Nadu	Groundnut Produc.	m.t.	0.68	1.24	0.85	0.98	0.99	1.18	1.08	
	Reference Price	Rs/q	368.41	276.32	241.99	330.15	321.92	300.83	268.44	
	Value	Rs. 10 m.	250.52	342.64	205.69	323.55	318.70	354.98	289.91	
	Value weight		0.23	0.25	0.26	0.22	0.26	0.40	0.29	0.27
	Total value	Rs. 10 m.	1110.17	1366.00	792.26	1430.23	1233.22	888.63	997.44	
	Aggregate value weight		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes: 1. Value is groundnut production multiplied by its refeence price.

2. For reference prices, see Annexures 6 to 8.

Annexure 10: Estimation of Regional (Value) Weights for Groundnut (with shell) (Exportable Hypothesis)

State	Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
Gujarat	Groundnut Produc.	m.t.	1.64	2.20	1.31	1.81	1.57	0.45	1.29	
	Reference price	Rs/q	275.92	227.89	196.34	259.06	257.58	229.28	190.91	
	Value	Rs. 10 m.	452.51	501.36	257.21	468.90	404.40	103.18	246.27	
	Value weight		0.48	0.46	0.39	0.38	0.41	0.15	0.35	0.37
Andhra Pradesh	Groundnut Produc.	m.t.	0.86	1.44	1.13	1.72	1.26	1.32	1.35	
	Reference price	Rs/q	318.59	219.37	199.10	279.72	255.35	226.31	192.00	
	Value	Rs. 10 m.	273.99	315.89	224.98	481.12	321.74	298.73	259.20	
	Value weight		0.29	0.29	0.35	0.39	0.32	0.45	0.36	0.35
Tamil Nadu	Groundnut Produc.	m.t.	0.68	1.24	0.85	0.98	0.99	1.18	1.08	
	Reference price	Rs/q	318.59	219.37	199.10	279.72	255.35	226.31	192.00	
	Value	Rs.10 m.	216.64	272.02	169.24	274.13	252.80	267.05	207.36	
	Value weight		0.23	0.25	0.26	0.23	0.27	0.40	0.29	0.28
	Total value	Rs. 10 m.	943.14	1089.27	651.43	1224.15	978.94	668.96	712.83	
	Aggregate Value weight		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes: 1. Value is groundnut production multiplied by its reference price.

2. For reference prices, see Annexures 11 to 13.

Annexure 11: Gujarat : Estimation of NPCs of Groundnut (with shell) (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1. Cif price of groundnut Kernels at Rotterdam (Oct-March)	$/MT	608.00	445.83	365.67[1]	438.00	380.83	355.00	293.00	
2. Minus insurance and freight from Rotterdam to Kandla[2]	$/MT	35.71	24.62	20.73	23.18	24.00	21.09	21.43	
3. Equals fob price at Kandla (Gujarat)	$/MT	572.29	421.21	344.94	414.82	356.83	333.91	271.57	
4. Exchange Rate (Oct-March)	1$=Rs.	7.99	9.17	9.82	10.53	12.41	12.17	13.00	
5. Equals fob price at Kandla = (Row 3 x Row 4)/10	Rs/q	457.26	386.25	338.73	436.81	442.83	406.37	353.04	
6. Minus approximate port charges[3]	Rs/q	5.00[e]	6.99	7.44	10.18	18.44	25.00[e]	30.00[e]	
7. Equals price of exportable groundnut Kernels at Kandla port(5-6)	Rs/q	452.26	379.26	331.29	426.63	424.39	381.37	323.04	
8. Reference price of groundnut pods[4] $\Rightarrow P_p^1 = (P_y - 32.86)/1.52$ (see Annexure 5)	Rs/q	275.92	227.89	196.34	259.06	257.58	229.28	190.91	
9. Wholesale price of groundnut pods in Gujarat[5] (Oct-March)	Rs.q	360.33	394.00	390.67	483.25	453.33	470.67	453.33	
10 NPCs of groundnut (with shell) (Row 9 / Row 8)		1.31	1.73	1.99	1.86	1.76	2.05	2.37	1.87

Notes: 1, 3, 4, 5 see Annexure 6.

2. Insurance is calculated at 1% of cif price at Rotterdam while freight is the same as that for US gulf to Rotterdam (See Annexure 4)

Annexure 12: Andhra Pradesh : Estimation of NPCs of Groundnut (with shell) (Exportable Hypothesis)

Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1. Cif price of groundnut kernels at Rotherdam (Oct-June)	$/MT	663.86	428.44	367.83[1]	461.00	377.78	348.00	296.00	
2. Minus insurance and freight from Rotterdam to Madras[2]	$/MT	36.27	24.44	20.74	23.41	23.97	21.02	21.46	
3. Equals fob price at Madras	$/MT	627.59	404.00	347.09	437.59	353.81	326.98	274.54	
4. Exchange Rate (Oct-June)	1$=Rs.	8.16	9.24	9.88	10.70	12.42	12.29	12.92	
5. Equals fob price at Madras (October-June)	Rs/q	512.11	373.30	342.92	468.22	439.43	401.86	354.71	
6. Minus port charges[3]	Rs/q	5.00[e]	6.99	7.44	10.18	18.44	15.00[e]	30.00[e]	
7. Equals price of exportable groundnut Kernels at Kandla Port(5-6)	Rs/q	517.11	366.31	335.48	458.04	420.99	376.86	324.71	
8. Reference price of groundnut pods[4] → P_p^h (P_k - 32.86)/1.52 (see Annex.5)	Rs/q	318.59	219.37	199.10	279.72	255.35	226.31	192.00	
9. Wholesale price of groundnut pods (Oct-June) in Nadyal (Andhra Pradesh)	Rs/q	377.44	376.78	397.78	431.56	449.11	458.12	600.00	
10. NPCs of groundnut pods (Row 9 / Row 8)		1.18	1.72	2.00	1.54	1.76	2.02	3.12	1.91

For Notes 1, 3, 4 see Annexure 6.

Note 2 see Annexure 11.

References same as in Annexure 6.

Annexure 13: Tamil Nadu : Estimation of NPCs of Groundnut (with shell) (Exportable Hypothesis)

	Particulars	Unit	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	Average
1.	Reference price of groundnut pods (same as that for Andhra Pradesh)	Rs/q	318.59	219.37	199.10	279.72	255.35	226.31	192.00	
2.	Wholesale price of groundnut pods in Tamil Nadu (Madras) (derived) by multiplying shelled peanut prices by a factor of 0.7)	Rs/q	385.58	373.22	420.00	465.97	451.42	458.27	604.80	
3.	NPCs of groundnut pods (Row 2 / Row 1)		1.21	1.70	2.11	1.67	1.77	2.02	3.15	1.95

Annexure 14: Input Structure of Groundnut (Selected States)
(Average of 1981-82 to 1983-84)

(Percentage)

Cost item	Gujarat	Andhra Pradesh	Tamil Nadu
1. Human labour	19.85	21.90	19.63
2. Bullock labour	11.79	10.43	6.72
3. Machine labour	3.11	0.19	0.74
4. Seed	19.65	20.02	23.10
5. Fertiliser	8.30	5.26	2.56
6. Manure	4.81	3.78	1.21
7. Insecticide	1.59	0.20	0.29
8. Irrigation	3.52	1.59	6.57
9. Interest on working capital	2.15	1.82	1.76
10 Rental value of owned land	17.60	29.36	25.42
11 Rent paid for leased in land	1.00	-	1.01
12 Land revenue and taxes	0.27	0.23	0.25
13 Depreciation on implements and farm buildings	0.93	1.35	0.91
14. Interest on fixed capital	5.42	3.86	9.83
15. Total Cost (Rs)	100.00 (3317.04)	100.00 (2619.81)	100.00 (3530.29)
16. Total value of output (main plus by product, Rs)	3665.07	2583.38	3884.90
17. Yield (Q/ha)	7.22	6.72	11.21

Source: Comprehensive Study for the Cost of Cultivation of Principal Crops in India Directorate of Economics and Statistics, Ministry of Agriculture.

Annexure 15: NPCs of Tradeable Inputs of Groundnut

	Seeds	Fertilisers	Farm Machinery (Tractors)	All Tradeable Inputs
Gujarat				
1980-81	1.09	0.77	1.26	1.02
1981-82	1.39	0.82	1.26	1.22
1982-83	1.63	0.97	1.26	1.42
1983-84	1.56	0.89	1.26	1.35
1984-85	1.40	0.72	1.26	1.20
1985-86	1.55	0.69	1.26	1.29
1986-87	1.69	0.91	1.26	1.44
Weights (Average of 1981-82 to 1983-84)	17.78	7.51	2.81	29.10
Andhra Pradesh				
1980-81	1.02	0.77	1.26	0.97
1981-82	1.36	0.82	1.26	1.25
1982-83	1.64	0.97	1.26	1.50
1983-84	1.31	0.89	1.26	1.22
1984-85	1.40	0.72	1.26	1.26
1985-86	1.52	0.69	1.26	1.35
1986-87	2.23	0.91	1.26	1.95
Weightes (average of 1981-82 to 1983-84)	20.30	5.33	0.19	25.82
Tamil Nadu				
1980-81	1.05	0.77	1.26	1.03
1981-82	1.35	0.82	1.26	1.30
1982-83	1.74	0.97	1.26	1.65
1983-84	1.41	0.89	1.26	1.35
1984-85	1.40	0.72	1.26	1.33
1985-86	1.52	0.69	1.26	1.43
1986-87	2.25	0.91	1.26	2.09
Weights (average of 1981-82 to 1983-84)	20.99	2.33	0.67	23.99
Three States Combined				
1980-81	1.05	0.77	1.26	1.00
1981-82	1.36	0.82	1.26	1.25
1982-83	1.67	0.97	1.26	1.51
1983-84	1.42	0.89	1.26	1.31
1984-85	1.40	0.72	1.26	1.26
1985-86	1.53	0.69	1.26	1.35
1986-87	2.07	0.91	1.26	1.81
Weights (sum of three States)	59.07	15.17	3.67	77.91

Note: Value weights have been estimated as percentage shares of these inputs in the total value of the output (main plus byproduct).

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